DEPARTMENT OF COMMERCE
BUREAU OF FOREIGN AND DOMESTIC COMMERCE
E. E. PRATT, Chief

MISCELLANEOUS SERIES—No. 37

THE COTTON-SPINNING MACHINERY INDUSTRY

REPORT ON THE COST OF PRODUCTION OF COTTON-SPINNING MACHINERY IN THE UNITED STATES

WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

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LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE,
BUREAU OF FOREIGN AND DOMESTIC COMMERCE,
Washington, January 22, 1916.

SIR: I beg to submit herewith a report on the cost of production of cotton-spinning machinery in the years 1906 to 1914, comprising a study of the manufacture of such machines as are used in the various processes from the opening of the bale to the spinning of the cotton.

This investigation was undertaken in accordance with the act of Congress approved August 23, 1912, establishing the Bureau of Foreign and Domestic Commerce. In addition to presenting the cost of production, the report contains information concerning manufacturing and selling methods, working conditions, imports and exports, and other features or conditions of this industry which were observed by the special agents.

While in earlier years the American cotton-textile industry was mainly dependent upon foreign manufacturers for machinery, this dependence has been gradually removed, and at the present time statistics obtained from cotton mills throughout the United States show that over 90 per cent of the cotton-textile machinery installed is of American manufacture.

Statistics of the value of imports and exports of cotton-spinning machinery are not available, but an examination of the invoices at the United States appraisers' offices in Boston, New York, and Philadelphia shows that the number of cotton-textile machines imported at these ports decreased from 1,132 in 1909 to 275 in 1914. The duty on these machines is 20 per cent ad valorem.

While the amount of exports of cotton-spinning machinery of the kind considered in this report is unknown, it was found upon inquiry among the manufacturers that it is very small, in fact almost negligible. There is a feeling among some manufacturers that the time is now ripe to branch out into the foreign markets.

In the investigation of the cost of production of cotton-spinning machinery, reports were received from three firms owning six plants in New England. These firms produce between 80 and 90 per cent of the domestic output of the machinery of the kind considered. The data cover a period of nine years. The net sales of all of these

establishments varied during the nine years from $12,837,892 in 1909 to $6,988,178 in 1914.

The concrete results of the investigation appear in the summary of this report, while the detailed information is given in the various chapters.

This investigation was conducted by Special Agent Edward S. Fawcett, with the assistance of Special Agent F. B. Meador. Special Agent Frank J. Sheridan made special inquiry concerning card clothing and obtained certain other facts that were incorporated in the report. The general direction of the office work and the editing of the report has been in charge of Gustavus A. Weber, expert in charge of the cost of production division, assisted by Henry J. Bierman.

E. E. PRATT,
Chief of Bureau.

To Hon. WILLIAM C. REDFIELD,
Secretary of Commerce.

THE COTTON-SPINNING MACHINERY INDUSTRY.

INTRODUCTION.

The cotton textile machinery plants included in this investigation have directed their efforts mainly to the manufacture of cotton-spinning machinery, the larger establishments making complete lines from the bale opener to the spinning frame. A few plain looms have also been made, and some little miscellaneous textile machinery. Combing machinery, used in the manufacture of fine soft yarn, has been made by only one firm. These machines are well protected by patents both here and abroad, and as the demand is not great for this special class of cotton machinery, the other firms would hardly be justified in spending large sums to develop their own machines in this direction, even though the firm now making combers has found them very profitable.

Mule spinning machinery has not been manufactured to any great extent in this country. During recent years it has been made by only one domestic manufacturer. The demand, however, is so small that he has made none during the last two years. The improvements made in ring spinning machinery have developed these machines to such a high degree of perfection that they are rapidly supplanting the mule machines for even very fine yarns.

Ring spinning is the commonly used method in this country. Mule spinning, a slower process, is an English method. An enumeration of cotton mills made for use in this report shows mills reporting slightly over 18,600,000 ring spindles and slightly less than 2,300,000 mule spindles. Each year the percentage of ring spinning is becoming greater.

Most of the other machines used in cotton mills, such as dyeing, printing, pressing, drying, cloth finishing, and other miscellaneous machines, including automatic looms, are not ordinarily made by the firms that make the spinning machinery. They are made by specialty shops, and for all practical purposes their manufacture may be considered a separate industry.

Some of the cotton-spinning machinery manufacturers also manufacture wool and worsted machinery, but not to any great extent. Their principal efforts have been directed to the development of strictly cotton machinery. The one cotton-machinery plant which has made the greatest effort to develop a trade in wool and worsted machinery has also manufactured some silk and paper machinery, and in the last few years accepted quite a large order for jute machinery. Until this order was placed all jute machinery was imported. Unfortunately for the development of such lines, this plant was under very conservative management, which made little effort to use modern manufacturing methods and permitted the establishment to fall

behind the times in every way. Within the last few years, however, it has come under the control of one of the most progressive firms, and in course of time will undoubtedly be brought up to date or else its business transferred to one of the firm's efficient shops.

The agents of the Bureau obtained establishment schedules for a series of years from the three firms which produce between 80 and 90 per cent of the cotton textile machinery made in this country. One of these firms operates four plants, located in three towns of two States, and the other two firms operate one plant each. These four plants were not under the same joint management during the entire period, however. Therefore they are considered as separate plants in the following tables, except in the tables showing per cent of profit on capital and surplus, etc., where the firm is considered as a unit. This difference was made because it was impossible to segregate the capital, etc., of the four individual plants. The method used was to combine the assets of all four plants and calculate the combined profits against this.

The figures obtained from one of the firms were for an even nine-year period from January 1, 1906, to January 1, 1915; from another firm, April 1, 1907, to January 1, 1915; for two of the plants of the third firm the figures cover a period of nine years and two months, or from May 1, 1905, to July 1, 1914; for the third plant of this group they cover seven years and nine months, from October 1, 1906, to July 1, 1914; for the fourth plant from October 1, 1906, to October 1, 1911, and from January 1 to July 1, 1914, or five and a half years. The figures for this plant for the period from 1911 to 1914 are included in the figures of the third plant.

Because of the many changes and differences in bookkeeping methods at the several plants over this long period, it was necessary that the items called for in the schedule be simplified as much as possible.

The following items were obtained:

1. *Materials used.*—Including all material purchased and adjustment of difference in inventory between the beginning and end of period; all supplies for shop and foundry and all material used in foundry.
2. *Pay roll.*—Total pay roll of shop and foundry, direct and indirect labor of all kinds, foremen and second hands, excepting those items which should be properly charged to selling or administration.
3. *Royalties.*—All royalty charges for patents used not the property of the firms.
4. *Repairs.*—This account appears in the books of one firm only and includes repairs to plant and equipment, also such items as files, drills, cutters, etc., amounting to about 20 per cent (estimated), which should be properly charged to supplies.
5. *Insurance.*—All insurance.
6. *Taxes.*—City, county, State, and Federal.
7. *Selling.*—All items properly chargeable to selling, salaries, traveling expenses and commissions of salesmen, advertising, branch-office expenses and salaries of employees at plant and head offices who are connected with sales force.
8. *Administration.*—Head-office expenses, including salaries, stationery, printing, postage, bad debts, and miscellaneous general expense. Traveling expenses of administrative officers.
9. *Miscellaneous.*—Miscellaneous items which could not be apportioned satisfactorily to the other accounts. This item appears in two plants, though at one plant it is very small.
10. *Total cost.*—The total of the preceding items.
11. *Manufacturing profit.*—Found by subtracting total cost from net sales.
12. *Net sales.*—Gross sales of new machines and repair parts, less returns, allowances, and discount.

13. *Interest, dividends on outside investments, etc., received.*—Interest on accounts and notes receivable, bank balances, etc., dividends on stocks in other companies, and interest on bonds owned by the firm.

14. *Other miscellaneous receipts.*—Sundry items, net rent from tenements, etc.

15. *Interest and other miscellaneous payments.*—Interest on borrowed money payable by the firm. Sundry miscellaneous payments.

16. *Final profit.*—Showing the final net profit of the firm, not including dividends or amounts set aside for special reserve funds.

Depreciation has been omitted from the figures of the foregoing schedule, not because it is considered an improper charge against manufacturing expense, but because the field agents found that in practically all cases many charges were made to the material and labor accounts which should properly have been charged to repairs or permanent improvements. These items would in their opinion much more than offset any possible charge for depreciation.

The fact that repair accounts were kept in few plants, and then did not represent the actual figures for repairs, made the separation of such items impossible.

Bad debts have been considered in the establishment schedule but not the loss or gain on mill stocks and bonds.

The acceptance of mill stocks and bonds as part payment and in some cases payment in full for machinery is fully discussed in another chapter. The manufacturers assert that their loss on this class of securities is great. The actual figures of loss or gain on such stocks are very hard to determine for any period owing to the way they are handled.

One of the three firms studied still retains virtually all such securities accepted within the last nine years, the period covered by this report. One retains the majority accepted during that time, very few having been sold and the remainder disbursed as dividends to the stockholders on a basis which required no determination of value. The third firm, an amalgamation of four plants, has sold or disbursed practically all security accepted. These plants have gone through a number of reorganizations within the period treated by the report and in some instances these securities have been retained by the old companies. The books of this firm, in one case, when the figures could be ascertained, show a loss on securities accepted between May 1, 1909, and February 1, 1911, of $146,168, and between July 1, 1913, and to July 1, 1914, a loss of $98,370.

An appraisal of securities now held by these firms would be very unsatisfactory. The securities have only a local market, in the vicinity of the mill, and in the majority of cases are not listed on any stock exchange.

SUMMARY.

COST OF PRODUCTION.

The cost of production was ascertained from three firms which conducted six plants. The product of these plants consists of cotton-spinning machinery from the bale opener to the spinning frame, besides which a few plain looms and some little miscellaneous textile machinery is made. These three firms produce between 80 and 90 per cent of the output of such machinery in this country. One of them operates four plants and the other two operate one plant each.

The years 1909 and 1910 are known to have been the most prosperous years this industry has experienced, and in the following comparisons 1909 will be termed the most profitable year, as against 1913, which is shown by the records to have been the least profitable year. It is evident that 1910 held approximately to the high level of 1909, or possibly exceeded it, but unfortunately for purposes of exact comparison, the figures for several of the plants for 1910 could not be satisfactorily obtained for the full yearly period. This leaves 1909 the highest year for which figures are available, and if it was not actually the most profitable year, the error in the assumption is obviously on the conservative side.

The combined net sales of these three firms amounted to $12,837,892 in 1909, and $7,440,916 in 1913, the average sales during the period being $9,981,711 per year.

On these sales there was a manufacturing profit of 22.94 per cent and a final profit of 25.04 per cent during the most profitable year, a manufacturing profit of 3.80 per cent and a final profit of 5.62 per cent during the least profitable year, and a manufacturing profit of 18.29 per cent and final profit of 20.24 per cent during the period. During the most profitable year the final profits in the six plants varied from 13.30 to 39.07 per cent of the net sales. During the least profitable year one plant had a final loss of 17.42 per cent, and the final profits of the other five varied from 0.37 to 34.68 per cent of the net sales.

When discussing profits, it is well to remember that the percentage of profit on net sales does not represent the percentage of profit on invested capital. The manufacturing profit on investment, for all three firms combined for the most profitable year, was 21.57 per cent, the final profit was 23.55 per cent; for the least profitable year the manufacturing profit was 2.05, the final profit 3.04; for the average year the manufacturing profit was 14.03, the final profit 15.53.

During the most profitable year the materials used in all the plants amounted to 47.50 per cent of the total manufacturing cost, the pay roll 42.32 per cent, selling expense 3.36 per cent, and administrative expense 2.34 per cent, the other items of manufacturing and selling cost amounting to 4.48 per cent.

During the least profitable year the total material cost was 39.66 per cent, the pay roll 47.37 per cent, the selling expense 5.15 per cent, the administrative expense 3.20 per cent, and the other items 4.62 per cent of the total manufacturing and selling cost.

The percentage of material cost was relatively higher and the labor cost (pay roll), selling, and administrative expense were relatively lower during the most profitable year than during the least profitable year.

The figures for individual establishments presented in this report show that the most profitable of the six plants varied but little in the percentage of profit from the most profitable to the least profitable year, while the least profitable plant varied from a profit of 13.30 per cent to a loss of 17.42 per cent of the net sales.

A comparison of the total figures for all plants from year to year shows that in 1906 and 1907 over ten million dollars' worth of machinery was sold, namely, $10,845,818 and $11,513,044, respectively; then the net sales dropped off to $8,622,966 in 1908, and increased to $12,837,892 in 1909 and $12,803,814 in 1910. After 1910 there was a steady decrease to $8,848,787 in 1911, $8,784,222 in 1912, $7,440,916 in 1913, and $6,988,178 in 1914.

The total profits rose and fell with the sales, although not in the same proportion, the amount of profits being not only dependent upon the volume of sales but in perhaps a greater degree upon the selling price of the product.

A comparison from year to year of the principal items of cost, based on the total manufacturing and selling expense, shows that the percentage of material cost has declined almost steadily from 1906 to 1914, while the labor cost or pay roll has steadily increased. The percentages of selling and administrative as well as the other items of expense fluctuated irregularly from year to year.

COST ACCOUNTING AND EFFICIENCY.

There has been a surprising lack of attention to cost accounting in the cotton-spinning machinery manufacturing plants visited by the agents. One large plant had practically no general bookkeeping system, except in the purchase department. It used an inadequate single-entry system. Another firm visited apparently made no effort to keep books except in the most old-fashioned way, and until two years ago had not taken an inventory of stock on hand for 25 or 30 years. At only one of the plants was there a unit-cost accounting system in use; this was not satisfactory and has since been superceded by a modern and accurate system.

There have unquestionably been many efforts made during the last 20 years to increase the manufacturing efficiency of the various plants. Many automatic and special tools have been introduced, and some shops have been specially equipped for the efficient production of certain machines.

In one instance a systematic effort was made to increase the general efficiency. A firm of efficiency engineers was engaged and an expert study was made of operations on an important part of a machine. The study was directed toward the possible improvement of machine tools, the better planning of the work, and the

introduction of the bonus system. With regard to the bonus system, the report of the experts indicates that its introduction in most instances brought decided increases in production, reductions in labor cost, and increases in the individual earnings of the workmen. At the time of the present investigation, the recommendations of the efficiency experts had not been adopted for general application in the plant.

SELLING METHODS.

The cotton textile machinery manufacturers have been very progressive in their selling methods. The heads of the concerns keep in constant touch with all orders and with the opportunities for making sales. Many of the larger orders are sold in person by members of the firms. Salesmen are kept continually on the road and are usually on a salary basis. These men make regular visits to the mills whether orders are expected or not, and thus keep the machinery manufacturers posted not only concerning possible orders but also concerning changes and improvements contemplated by the mills.

The machinery manufacturers have frequently helped to finance the organization and expansion of cotton mills by extending large and long credits and by the acceptance of mill stocks and bonds in part or entire payment for machinery which is installed.

All machines when completed are first assembled and erected and tested at the shop, after which they are taken down and again erected at the cotton mill. Machines sold to New England spinners are erected and put in running order at the mills free of charge. Outside of New England machines are sold f. o. b. machine shop, and the mill pays all freight and erection charges. Southern offices are maintained by all large firms for convenience in selling to southern cotton mills. Supplies of card-clothing and other common repair parts are kept at these local offices, and repair and erecting men are also stationed there in order to be quickly available for rush orders.

PRICES.

For some years the machinery manufacturers had a sales price agreement, but it is a question whether this was ever observed. So long as the demand for machinery was large it was easy to keep up the prices, but the instant the demand began seriously to drop off the severest competition began and prices fell accordingly.

WORKING CONDITIONS.

There have been practically no labor troubles in this industry. Few highly skilled men are employed except as foremen, second hands, erectors, and machinists in the tool department. Most of the employees are machine hands, an occupation which requires very little training. The number of men employed by the three firms reported upon varied from 6,500 during dull times to 8,500 during the busier years.

The general working conditions were found to be good in all the establishments visited. The men appeared to be well treated and seemed to be contented and to like their work. In some plants persons have been employed continuously for 50 years or more.

The fact that no strikes of any importance have occurred in this industry is convincing proof of the ability of the administrative officers to understand and direct labor. Of the plants visited none has the reputation of being a "drive shop." Many things are done for the welfare of the workmen. The plants are clean, light, and in every way sanitary, adding much both to the convenience and health of the workmen and the efficiency of the shop as a whole. The machinery is well protected, and the danger of accident reduced to a minimum. Where dust, filings, and other dangerous substances are found blowing systems have been installed to carry them away. In the brass foundries, where dangerous gases are formed, it is customary to change the men every two weeks, those relieved returning to the iron foundry, from which they had come. While at work in the brass foundry their pay is increased, and, on account of the increased pay, a molder is considered fortunate to get such work, the exposure to the gases not being long enough to endanger his health.

In some places good houses are furnished for the married workmen at a rental much below the average local rate. In two cases hotels have been built for the accommodation of workmen with no families. The hotels are models of their kind, and in fact the food served is much better than at the average hotel in a small town. The rates are moderate. Where possible boat clubs, bowling alleys, billiard and pool rooms, athletic fields, and other means of entertainment at reduced rates are maintained.

Statistics of wages of the employees in each of the establishments visited were obtained for pay periods in 1906, 1908, 1910, and 1914. They show that the average wages generally increased from year to year. Both time and piece rates of wages are paid, and in some cases bonuses are added to the regular wages. Detailed wage tables are shown in the chapter on working conditions.

IMPORTS AND EXPORTS.

There are no available official statistics published showing the imports and exports of cotton-spinning machinery from the bale opener to the spinning frame, such as would enter into competition with the establishments covered by the investigation. In order to obtain such information original compilations were made from the invoices on file at the offices of the United States appraisers in Boston, New York, and Philadelphia, showing the imports of each kind of machine from 1909 to 1915. The figures obtained from this source show a steady and rapid decline in such imports during this period. There is a duty of 20 per cent ad valorem on these imports.

RELATIVE MERITS OF FOREIGN AND DOMESTIC MACHINERY.

It is of course much more convenient for American mills to buy their machinery from manufacturers in this country. Details of design can be more expeditiously arranged, and all dealings can be conducted with the actual executive head of the establishment, which is always a great advantage. By purchasing in this country, the cotton mills may also obtain repair parts much more promptly than if they imported their machinery.

Another important consideration to the mills is the fact that the machinery firms, being large and well financed, are able and willing to allow long-time credits. They frequently accept, in lieu of cash, stocks and bonds of the cotton mills they equip with machinery.

Where English cotton textile machines are used in American mills it is usually on account of certain special qualifications. The English cards are said to be more durable and to have heavier castings and stronger bearings, and they are sold at a higher price than the American cards. With regard to the other machines, however, there is little difference.

CARD CLOTHING.

While card clothing is an essential part of cotton-spinning machinery, it is not manufactured in any of the establishments considered in this report, but supports an industry in itself. There are five establishments in the United States that make the bulk of the card clothing used in both the cotton and woolen and worsted industries. Of these five there is but one establishment that gives its whole attention to the manufacture of cotton card clothing. Complete information concerning its cost of production can not be published without possible disclosure of the operations of that establishment. Some general information concerning the manufacture of cards and card clothing is given in the chapter under this title.

CHAPTER I.

THE COTTON TEXTILE MACHINERY INDUSTRY IN THE UNITED STATES.

DEVELOPMENT OF THE INDUSTRY.

The present importance of the cotton textile machinery industry in the United States is a development of the last 25 years. So far as this country is concerned, the phenomenal rise of the cotton trades was by no means paralleled in the manufacture of the implements required for them.

Up to 1831, when the Census figures show 801 cotton factories in the United States, with 1,246,703 spindles in operation, there had come into existence but one shop which manufactured cotton-textile machinery. This had been built at Lowell, Mass., in 1824. About 1831 or 1832 another shop was opened at Whitinsville, Mass., and still another at Newton Upper Falls. During the next 60 years the number of cotton spindles in operation in the United States multiplied itself almost fourteen times, but the corresponding demands for cotton-spinning machinery were not supplied by American machine shops.

Two factors retarded the development of the machinery industry. The English manufacturers had held the market of the colonies, of course, and it was not until 1808 that the United States began to depend upon her own industries. Even then England, as the center of cotton manufacturing and textile-machinery trades, influenced the New England mills, both directly and indirectly. Much of the stock was owned by Englishmen, who frequently could dictate as to the source of the machinery. Practically all the important mill workers, such as foremen and second hands, were English, the superintendents being, almost without exception, English or Scotch. Both these and the rest of the mill force were accustomed to English machinery and preferred it on that account.

Besides this, the American machinery manufacturers, making large profits on what they did sell, lacked incentive to improvement. They were content to copy English models, without effort even to eliminate English mistakes, and they settled apparently into an inertia which was not overcome until about 1890.

Activity and enterprise in the cotton textile machinery industry, however, once it began in earnest, has continued with vigor and marked practical results, the last 25 years having given the American markets largely into the hands of the home manufacturers. In 1899, according to Census reports, the cotton mills consumed 1,817,643,390 pounds of cotton. In 1914 they consumed 2,942,366,500 pounds. The machinery manufacturers have kept pace with the increasing needs of the mills, adopting English methods and improving them, and spending much money on experiment. Conditions have favored

them, also, in the fact that ring spinning, an American invention, developed into the principal American method during this interval and superseded mule spinning, the English method.

The industry is now in the hands of seven firms, the three largest of which operate six plants and make 80 to 90 per cent of all the cotton-spinning machinery that is produced in this country. The three early plants are still in existence and form the nucleus of the two largest firms now in the business. The third of the large firms was an English corporation, formed in 1894, with a plant in Massachusetts just outside of Pawtucket, R. I. This establishment was later reorganized and incorporated under the laws of the United States.

To show the development of the cotton industry, and consequently to suggest the extent of the market which the machinery manufacturers supply, the following table has been compiled from the United States Census reports.

Table 1 shows the number of cotton spindles in operation in the United States at the time of each census period and in 1914.

TABLE 1.—NUMBER OF COTTON SPINDLES IN OPERATION IN THE UNITED STATES, SHOWN BY GROUPS OF STATES FOR EACH CENSUS PERIOD AND 1914.

[Compiled from United States Census reports.]

Year.	United States.	New England States.	Southern States.	Middle States.	Western States.
1831	1,246,703	823,726	81,872	341,105	.....
1860	5,235,727	3,858,962	391,920	949,111	35,734
1870	7,132,415	5,498,308	446,317	1,127,399	60,391
1880	10,653,435	8,632,087	713,942	1,219,270	88,136
1890	14,384,180	10,934,297	1,779,300	1,500,317	170,266
1900	19,463,984	13,165,809	4,539,290	1,530,051	228,834
1910	28,178,862	15,735,086	10,553,678	1,661,932	228,166
1914	32,744,012	17,682,526	13,118,652	1,698,042	244,792

From data compiled from the United States Census reports the following comparison can be made of the estimated number of cotton-spinning spindles in use in 1914: United States, 32,744,012; Great Britain, 55,971,501; Germany, 11,404,944; Russia, 9,111,835; France, 7,400,000; India, 6,397,141; and all other countries about 20,000,000.

COMPETITIVE EXPANSION OF THE INDUSTRY.

The list of American textile-machine manufacturers and the names of the machines made by them on page 99 shows that it is possible for an American manufacturer of cotton textiles to equip his mill wholly from American sources of supply. Machine manufacturing establishments have grown and developed with the corresponding expansion of the cotton-mill industry. Large concerns which began with the building of a single machine 90 years ago have expanded to such a degree that they now make a complete line of cotton textile machines. While there has been a consolidation of shops, there has been no industrial combination or trust in the industry. The various concerns are competitive in their operations.

CHAPTER II.

COST OF PRODUCTION OF COTTON-SPINNING MACHINERY.

A thorough study was made of the accounts of six manufacturing plants, covered by three firms, these six plants producing over 80 per cent of the total domestic output of cotton-spinning machinery. Cost of production figures were obtained from these plants for a period of nine years.

In order to give a comprehensive view of the industry it was decided to show the figures in the principal tables for the most profitable year, the least profitable year, and an average year. The average yearly figures were obtained by dividing the total actual figures obtained from each plant by the number of years and fraction thereof which they covered, and these were combined for the total of the industry.

The years 1909 and 1910 are known to have been the most prosperous years this industry has experienced, and in the following comparisons 1909 will be termed the most profitable year, as against 1913, which is shown by the records to have been the least profitable year. It is evident that 1910 held approximately to the high level of 1909, or possibly exceeded it, but unfortunately for purposes of exact comparison, the figures for several of the plants for 1910 could not be satisfactorily obtained for the full yearly period. This leaves 1909 the highest year for which figures are available, and if it was not actually the most profitable year the error in the assumption is obviously on the conservative side.

RANGE OF COSTS AND PROFITS IN NINE-YEAR PERIOD.

Table No. 2 shows that the combined net sales of the three firms studied were as follows: Most profitable year, $12,837,892; least profitable year, $7,440,916; average year, $9,981,711.

The manufacturing profit was: Most profitable year, $2,945,184 (22.94 per cent of net sales); least profitable year, $282,440 (3.80 per cent of net sales); average year, $1,825,743 (18.29 per cent of net sales).

The final profit was: Most profitable year, $3,215,210 (25.04 per cent of net sales); least profitable year, $418,194 (5.62 per cent of net sales; average year, $2,020,929 (20.24 per cent of net sales).

The range of net sales from the high to the low year was $5,396,976, of manufacturing profit $2,662,744, and of final profit $2,797,016. The difference in the profits during the most and least profitable years is caused by two factors, reduction in volume of sales and reduced selling price, both of which materially tend to reduce profits.

TABLE 2.—MANUFACTURING PROFIT AND FINAL PROFIT OF THREE FIRMS, COMBINED, FOR MOST PROFITABLE, LEAST PROFITABLE, AND AVERAGE YEARS, SHOWING ALSO PERCENTAGES OF ITEMS BASED ON NET SALES AND ON TOTAL COST.

Items.	Most profitable year.			Least profitable year.			Average year.		
	Amount.	Percentage based on—		Amount.	Percentage based on—		Amount.	Percentage based on—	
		Net sales.	Total cost.		Net sales.	Total cost.		Net sales.	Total cost.
Materials used	$4,698,743	36.60	47.50	$2,838,943	38.15	39.66	$3,725,330	37.32	45.68
Pay roll (salaries and wages)	4,186,749	32.61	42.32	3,391,081	45.57	47.37	3,468,748	34.75	42.53
Royalties	105,762	.82	1.07	36,583	.49	.51	107,224	1.08	1.32
Repairs	163,591	1.28	1.65	83,655	1.12	1.17	134,142	1.34	1.64
Insurance	12,822	.10	.13	21,932	.30	.31	12,359	.12	.15
Taxes	118,610	.92	1.20	135,874	1.83	1.90	108,489	1.09	1.33
Selling expense	331,987	2.59	3.36	368,893	4.96	5.15	334,903	3.36	4.11
Administrative expense	231,717	1.81	2.34	229,153	3.08	3.20	222,947	2.23	2.73
Miscellaneous	42,697	.33	.43	52,362	.70	.73	41,826	.42	.51
Total cost	9,892,708	77.06	100.00	7,158,476	96.20	100.00	8,155,968	81.71	100.00
Net sales	12,837,892	100.00	.....	7,440,916	100.00	.....	9,981,711	100.00	.....
Manufacturing profit	2,945,184	22.94	.....	282,440	3.80	.....	1,825,743	18.29	.....
Interest, dividends on outside investments, etc., received	378,421	2.95	.....	275,646	3.70	.....	298,660	2.99	.....
Other miscellaneous receipts	92,703	.72	.....	84,776	1.14	.....	95,478	.95	.....
Total	3,416,308	26.61	.....	642,862	8.64	.....	2,219,881	22.23	.....
Less interest and miscellaneous payments	201,098	1.57	.....	224,668	3.02	.....	198,952	1.99	.....
Final profit	3,215,210	25.04	.....	418,194	5.62	.....	2,020,929	20.24	.....

Materials show little change in price over the period; while some materials have advanced in price others have diminished.

Wages, however, as shown in the wage tables in Chapter VII, have advanced. The percentage of pay roll based on net sales was 12.96 higher in the least profitable year than in the most profitable year, while the per cent of pay roll based on total cost was only 5.05 higher.

Total cost is in no way affected by selling prices, while net sales are. This difference is readily understood when it is remembered that there has been a material reduction of selling prices during dull years.

It is interesting to note that the amount of selling expense for the most profitable and the average year was substantially the same, and it was more by $33,000 for the least profitable year. This is perhaps explained by the fact that selling organizations are more important and the necessity to fight for business greater during the dull than prosperous years.

The amount expended for administration showed little variation from one period to another.

It is well to remember, when considering the tables, that the item called repairs includes only the repairs of one firm and not all of these, the remaining repairs of this firm and all the repairs of the other two firms being included in material and pay-roll accounts.

MOST PROFITABLE YEAR.

Table 3 shows the costs and profits for all six plants separately for the most profitable year in each case. Percentages only are used, because the use of figures would easily identify the different plants.

As applied to the figures for the separate plants, the terms "most profitable" and "least profitable" year refer to such years at the respective plants. At five of the plants the most profitable year was 1909, at one it was 1910; at five of the plants the least profitable year was 1913, at one it was 1914.

TABLE 3.—PERCENTAGE OF COST OF EACH SPECIFIED ITEM OF EXPENSE AND PROFIT, BASED ON NET SALES AND ON TOTAL COST, BY SEPARATE PLANTS, FOR THE MOST PROFITABLE YEAR.

Items.	Plant No. 1.		Plant No. 2.		Plant No. 3.	
	Per cent of net sales.	Per cent of total cost.	Per cent of net sales.	Per cent of total cost.	Per cent of net sales.	Per cent of total cost.
Materials used	41.75	55.78	37.63	52.32	37.26	41.71
Pay roll (salaries and wages)	26.44	35.32	29.04	40.37	43.34	48.53
Royalties	.....	.....	.73	1.02	.76	.85
Repairs	1.48	1.98	1.33	1.84	3.86	4.32
Insurance	.14	.19	.09	.13	.11	.13
Taxes	.94	1.25	.34	.47	1.11	1.24
Selling expense	2.41	3.22	1.66	2.31	.94	1.05
Administrative expense	1.63	2.18	1.40	1.54	2.14	2.39
Miscellaneous	.05	.08	.....	.....	.....	.....
Total cost	74.84	100.00	71.92	100.00	89.32	100.00
Net sales	100.00	.....	100.00	.....	100.00	.....
Manufacturing profit	25.16	.....	28.08	.....	10.68	.....
Interest, dividends on outside investments, etc., received	3.80	.....	2.57	.....	2.51	.....
Other miscellaneous receipts	.29	.....	.07	.....	.74	.....
Total	29.25	.....	30.72	.....	13.93	.....
Less interest and miscellaneous payments	.16	.....	.11	.....	.63	.....
Final profit	29.09	.....	30.61	.....	13.30	.....

Items.	Plant No. 4.		Plant No. 5.		Plant No. 6.	
	Per cent of net sales.	Per cent of total cost.	Per cent of net sales.	Per cent of total cost.	Per cent of net sales.	Per cent of total cost.
Materials used	36.67	58.49	36.43	50.56	31.14	42.98
Pay roll (salaries and wages)	16.60	26.47	28.39	39.40	32.88	45.38
Royalties	1.02	1.62	.23	.32	1.62	2.24
Repairs	2.51	4.00	.....	.....	.....	.....
Insurance	.08	.13	.14	.19	.06	.08
Taxes	.96	1.55	2.09	2.90	.60	.83
Selling expense	1.98	3.16	3.10	4.29	3.50	4.83
Administrative expense	2.87	4.58	1.68	2.34	1.80	2.48
Miscellaneous	.....	.....	.....	.....	.85	1.18
Total cost	62.69	100.00	72.06	100.00	72.45	100.00
Net sales	100.00	.....	100.00	.....	100.00	.....
Manufacturing profit	37.31	.....	27.94	.....	27.55	.....
Interest, dividends on outside investments, etc., received	1.47	.....	4.18	.....	3.32	.....
Other miscellaneous receipts	.21	.....	.....	.....	1.30	.....
Total	39.07	.....	32.12	.....	32.17	.....
Less interest and miscellaneous payments	.....	.....	2.75	.....	2.03	.....
Final profit	39.07	.....	29.37	.....	30.14	.....

It should be borne in mind that these are the six plants making up the three firms studied, that some of these plants make complete lines of machinery, and that others are highly developed specialty shops making a few, and in one case only one kind of machines. It is somewhat unsafe to make too fine a comparison between these plants, for in many cases the conditions are very different.

The most profitable plant shown in this table had a final profit of 39.97 per cent of sales, and the least profitable 13.30 per cent; the other four plants were making very nearly the same percentage of profit, 29.09, 29.37, 30.14, 30.61, respectively.

It is very interesting to note that with the exception of the high and the low plant the percentages of the items of cost on the net-sales basis vary little among the remaining four plants, showing that though some are specialty shops and others are making full lines of machinery, and though the manufacturing methods and local conditions may vary, they are obtaining practically the same results.

The greatest range is that of pay roll, from 16.60 to 43.34. This difference is partly accounted for by the fact that the plant with the low pay-roll figures purchased the majority of its castings, which would decrease the pay roll and increase the material account.

LEAST PROFITABLE YEAR.

Table 4 shows the items of cost for the six plants for the least profitable year, on a percentage basis. Plant No. 3 shows a loss of 17.42 per cent of net sales for the final profit, and plant No. 4 shows a profit of 34.68 per cent. The remaining four plants show profits, but of varying amounts, contrary to the preceding table, where their percentages of profit were so nearly alike. The final profits in this table for the four remaining plants were 0.37, 6.71, 7.17, and 19.13 per cent of the net sales, respectively.

This difference is to a great extent accounted for by the conditions governing sales during a dull year. During prosperous years the plants are all running at capacity, prices are firm and are on the same level from plant to plant. During dull years the conditions are very different, sharp competition is the rule, and prices vary greatly. Some of the plants secure more business than others or are more fortunate in obtaining better prices, hence the variation in percentage of profit.

TABLE 4.—PERCENTAGE OF COST OF EACH SPECIFIED ITEM OF EXPENSE AND PROFIT, BASED ON NET SALES AND ON TOTAL COST, BY SEPARATE PLANTS, FOR THE LEAST PROFITABLE YEAR.

Items.	Plant No. 1.		Plant No. 2.		Plant No. 3.	
	Per cent of net sales.	Per cent of total cost.	Per cent of net sales.	Per cent of total cost.	Per cent of net sales.	Per cent of total cost.
Materials used	48.92	49.25	41.17	44.71	40.86	34.87
Pay roll (salaries and wages)	38.59	38.85	41.08	44.62	62.89	53.66
Royalties			.10	.11		
Repairs	2.01	2.03	1.27	1.38	3.82	3.26
Insurance	.46	.46	.21	.23	.46	.40
Taxes	2.54	2.56	1.48	1.61	1.97	1.69
Selling expense	3.99	4.01	3.97	4.31	4.18	3.57
Administrative expense	2.82	2.84	2.79	3.03	3.00	2.55
Miscellaneous						
Total cost	99.33	100.00	92.07	100.00	117.18	100.00
Net sales	100.00		100.00		100.00	
Manufacturing profit	.67		7.93		[a] 17.18	
Interest, dividends on outside investments, etc., received	2.16		2.20		1.76	
Other miscellaneous receipts	.63		.14		.91	
Total	3.46		10.27		[a] 14.51	
Less interest and miscellaneous payments	3.09		3.10		2.91	
Final profit	.37		7.17		[a] 17.42	

Items.	Plant No. 4.		Plant No. 5.		Plant No. 6.	
	Per cent of net sales.	Per cent of total cost.	Per cent of net sales.	Per cent of total cost.	Per cent of net sales.	Per cent of total cost.
Materials used	33.62	51.60	46.70	52.85	32.89	33.99
Pay roll (salaries and wages)	24.33	37.35	29.94	33.89	49.25	50.90
Royalties	.07	.11	.54	.61	1.13	1.17
Repairs	.46	.71				
Insurance	.28	.44	.29	.33	.17	.18
Taxes	.93	1.42	2.39	2.71	1.67	1.72
Selling expense	3.53	5.42	5.59	6.33	6.07	6.27
Administrative expense	1.92	2.95	2.91	3.28	3.54	3.66
Miscellaneous					2.01	2.11
Total cost	65.14	100.00	88.36	100.00	96.76	100.00
Net sales	100.00		100.00		100.00	
Manufacturing profit	34.86		11.64		3.24	
Interest, dividends on outside investments, etc., received	3.49		8.51		4.45	
Other miscellaneous receipts					2.58	
Total	38.35		20.15		10.27	
Less interest and miscellaneous payments	3.67		1.02		3.56	
Final profit	34.68		19.13		6.71	

[a] Loss.

Taxes, which in the most prosperous year were less than 1 per cent of sales at four of the plants, during the least prosperous year were more than 1 per cent in all but one of the plants, two plants having had taxes over 2 per cent of sales. Insurance was at all plants less than one-half of 1 per cent during the most as well as the least profitable year, being as low as 0.17 at plant No. 6 in the least profitable year and 0.06 at the same plant in the most profitable year.

AVERAGE YEAR.

Table 5 shows the average yearly figures of each of the six plants on a percentage basis.

TABLE 5.—PERCENTAGE OF COST OF EACH SPECIFIED ITEM OF EXPENSE AND PROFIT, BASED ON NET SALES AND ON TOTAL COST, BY SEPARATE PLANTS, FOR THE AVERAGE YEAR.

Items.	Plant No. 1.		Plant No. 2.		Plant No. 3.	
	Per cent of net sales.	Per cent of total cost.	Per cent of net sales.	Per cent of total cost.	Per cent of net sales.	Per cent of total cost.
Materials used	42.36	52.99	38.40	48.16	42.77	44.65
Pay roll—salaries and wages	29.66	37.10	33.89	42.51	42.30	44.17
Royalties			1.31	1.65	.69	.72
Repairs	1.84	2.30	1.39	1.74	3.98	4.16
Insurance	.10	.12	.08	.09	.19	.20
Taxes	.90	1.12	.59	.74	1.27	1.32
Selling expense	3.06	3.83	2.43	3.04	1.98	2.07
Administrative expense	2.00	2.50	1.60	2.01	2.60	2.71
Miscellaneous	.03	.04	.05	.06		
Total cost	79.95	100.00	79.74	100.00	95.78	100.00
Net sales	100.00		100.00		100.00	
Manufacturing profit	20.05		20.26		4.22	
Miscellaneous receipts	.14		.09		.28	
Interest, dividends on outside investments, etc., received	3.23		2.45		2.56	
Total	23.42		22.80		7.06	
Less interest and miscellaneous payments	1.09		.96		1.71	
Final profit	22.33		21.84		5.35	

Items.	Plant No. 4.		Plant No. 5.		Plant No. 6.	
	Per cent of net sales.	Per cent of total cost.	Per cent of net sales.	Per cent of total cost.	Per cent of net sales.	Per cent of total cost.
Materials used	37.82	57.40	38.64	50.44	31.10	38.79
Pay roll—salaries and wages	17.89	27.15	29.08	37.97	38.10	47.52
Royalties	1.19	1.81	.51	.67	1.80	2.24
Repairs	2.47	3.75				
Insurance	.12	.18	.18	.23	.09	.12
Taxes	.77	1.17	2.01	2.62	.95	1.18
Selling expense	2.25	3.41	3.99	5.20	4.65	5.80
Administrative expense	3.31	5.02	2.19	2.87	2.21	2.76
Miscellaneous	.07	.11			1.28	1.59
Total cost	65.89	100.00	76.60	100.00	80.18	100.00
Net sales	100.00		100.00		100.00	
Manufacturing profit	34.11		23.40		19.82	
Miscellaneous receipts	.25				2.15	
Interest, dividends on outside investments, etc., received	1.41		5.46		3.00	
Total	35.77		28.86		24.97	
Less interest and miscellaneous payments	.61		2.75		2.69	
Final profit	35.16		26.11		22.28	

RECAPITULATION FOR EACH PLANT FOR MOST PROFITABLE, LEAST PROFITABLE, AND AVERAGE YEARS.

In Table 6 are recapitulated the final profits on net sales in each plant for the most profitable, the least profitable, and the average year:

TABLE 6.—FINAL PROFIT OF THE SIX PLANTS FOR THE MOST PROFITABLE YEAR, THE LEAST PROFITABLE YEAR, AND THE AVERAGE YEAR, BY PERCENTAGES BASED ON NET SALES.

Plants.	Most profitable year.	Least profitable year.	Average year.	Plants.	Most profitable year.	Least profitable year.	Average year.
No. 1	29.09	0.37	22.33	No. 4	39.07	34.68	35.16
No. 2	30.61	7.17	21.81	No. 5	29.37	19.13	26.11
No. 3	13.30	[a]17.42	5.35	No. 6	30.14	6.71	22.28

[a] Loss.

It will be noticed in the foregoing tables that plant No. 3 at all times shows the lowest percentage of final profit and that plant No. 4 shows the highest. Plant No. 3 is the only plant that shows a loss at any period. The other four plants make approximately the same percentage for the most profitable year and vary only slightly for the average year.

LABOR COST.

Table 7 gives a summary of the percentage of labor cost (pay roll) based on total cost in each plant during each of the three periods:

TABLE 7.—PAY ROLL OF THE SIX PLANTS FOR THE MOST PROFITABLE YEAR, THE LEAST PROFITABLE YEAR, AND THE AVERAGE YEAR, BY PERCENTAGES BASED ON TOTAL COST.

Plants.	Most profitable year.	Least profitable year.	Average year.	Plants.	Most profitable year.	Least profitable year.	Average year.
No. 1	35.32	38.85	37.10	No. 4	26.47	37.35	27.15
No. 2	40.37	44.62	42.51	No. 5	39.40	33.89	37.97
No. 3	48.53	53.66	44.17	No. 6	45.38	50.90	47.52

Basing the percentage figures of cost items on total cost gives a clearer comparison than using the net sales basis. Total cost is not affected by changes in selling price while net sales are.

Some manufacturers have been under the impression that during dull years the percentage of labor cost increased very greatly because it was necessary to retain the more skilled men who were receiving the higher rates. Using net sales as the basis of the percentage figures and taking just a superficial view, such would be the deduction. Using total cost as the base and remembering the effect of reduced prices upon net sales, we find that though the least profitable year at most plants shows a greater percentage for labor cost, the greatest difference between the most profitable and the least profitable year was at plant No. 4, where it was 10.88 per cent greater in

the least profitable year. This is not entirely reflected in the final profits of this plant, however, which were 39.07 per cent, based on net sales for the most profitable year and 34.68 per cent for the least profitable year. The other plants showed increases from 3.53 to 5.52 per cent of total cost, while one plant showed a decrease of 5.51 per cent in the least profitable as compared with the most profitable year.

A detailed analysis of the pay roll at two pay periods is given in Table 8 for one firm making a complete line of cotton-spinning machinery.

TABLE 8.—PAY-ROLL DISTRIBUTION OF ONE FIRM MAKING A COMPLETE LINE OF COTTON-SPINNING MACHINERY.

Items.	Jan. 11, 1913.	July 19, 1913.
INDIRECT LABOR.	*Per cent.*	*Per cent.*
Office	1.69	2.54
Drafting room	1.01	1.38
Foremen	1.97	2.66
Tool room	1.69	3.22
Yard	4.80	4.56
Pattern and tool makers	1.19	1.50
Engineers, electricians, etc	.81	1.16
Repairs	2.40	2.17
Foundry	1.37	.90
Total	16.93	20.09
DIRECT LABOR.		
Foundry	20.84	18.45
Machine shop	59.40	58.06
Erecting at mill	2.83	3.40
Total	83.07	79.91
Grand total	100.00	100.00

This table gives some idea of the pay-roll distribution at the several plants. It can be considered as typical of the industry as a whole for the year 1913, which was the dull period.

MOST PROFITABLE AND LEAST PROFITABLE PLANTS.

Table 9 shows items of cost for the most profitable and the least profitable plants for the most profitable year, on a percentage basis. Too fine a comparison should not be made as the manufacturing conditions are very different. At the same time it is well to remember that both are making cotton machinery and the conditions have been to a great extent controlled by the administrative policies developed.

At this point it may be well to note that, according to the preceding tables, there is ordinarily little difference between the percentage of profit made by a highly developed specialty shop and a well-managed plant making a complete line of machinery. The final profit for the first plant is 39.07 per cent of net sales and for the second, 13.30 per cent. The greatest difference in the items of cost is between the percentages for pay roll, the first having 16.60 and the second 43.34 per cent on a net sales basis, or 26.47 and 48.53, respectively, on a total cost basis. This difference is partially accounted for by the fact that the first plant purchased many of its

castings. There is no other great difference in the percentages on the net sales basis. The difference in labor cost is practically the same as the difference in manufacturing profit.

TABLE 9.—PERCENTAGE OF COST OF EACH SPECIFIED ITEM OF EXPENSE AND PROFIT, BASED ON NET SALES AND ON TOTAL COST, FOR THE MOST PROFITABLE PLANT AND THE LEAST PROFITABLE PLANT DURING THE MOST PROFITABLE YEAR.

Items.	Percentage on net sales.		Percentage on total cost.	
	Most profitable plant.	Least profitable plant.	Most profitable plant.	Least profitable plant.
Materials	36.67	37.26	58.49	41.71
Pay roll (salaries and wages)	16.60	43.34	26.47	48.53
Royalties	1.02	.56	1.62	.63
Repairs	2.51	3.86	4.00	4.32
Insurance	.08	.11	.13	.13
Taxes	.96	1.11	1.55	1.24
Selling expense	1.98	.94	3.16	1.05
Administrative expense	2.87	2.14	4.58	2.39
Miscellaneous	.....	.....	.....	.....
Total cost	62.69	89.32	100.00	100.00
Net sales	100.00	100.00	.....	.....
Manufacturing profit	37.31	10.68	.....	.....
Interest and dividends on outside investments, etc., received	1.47	2.51	.....	.....
Other miscellaneous receipts	.29	.74	.....	.....
Total	39.07	13.93	.....	.....
Less interest and miscellaneous payments	.....	.63	.....	.....
Final profit	39.07	13.30	.....	.....

Table 10 shows the most profitable and the least profitable plant for the least profitable year, on a percentage basis.

The first plant shows a final profit of 34.68 per cent on a net sales basis, while the second shows a loss of 17.42 per cent. As in the preceding table, showing the same plants for the most prosperous year, the difference in pay roll is the only great difference in the items of costs. Pay roll at the first plant is 24.33 and at the second 62.89 per cent on a net sales basis, which represents the greater part of the difference between the final profits.

TABLE 10.—PERCENTAGE OF COST OF EACH SPECIFIED ITEM OF EXPENSE AND PROFIT OR LOSS, BASED ON NET SALES AND ON TOTAL COST, FOR THE MOST PROFITABLE PLANT AND THE LEAST PROFITABLE PLANT FOR THE LEAST PROFITABLE YEAR.

Items.	Percentage on net sales.		Percentage on total cost.	
	Most profitable plant.	Least profitable plant.	Most profitable plant.	Least profitable plant.
Materials	33.62	40.86	51.60	34.87
Pay roll (salaries and wages)	24.32	62.89	37.35	53.66
Royalties	.07	.....	.11	.....
Repairs	.46	3.82	.71	3.26
Insurance	.28	.46	.44	.40
Taxes	.93	1.97	1.42	1.69
Selling expense	3.53	4.18	5.42	3.57
Administrative expense	1.92	3.00	2.95	2.55
Miscellaneous	.....	.....	.....	.....
Total cost	65.14	117.18	100.00	100.00
Net sales	100.00	100.00	.....	.....
Manufacturing profit	34.86	[a] 17.18	.....	.....
Interest and dividends on outside investments, etc., received	3.49	1.76	.....	.....
Other miscellaneous receipts	.....	.91	.....	.....
Total	38.35	[a] 14.51	.....	.....
Less interest and miscellaneous payments	3.67	2.91	.....	.....
Final profit	34.68	[a] 17.42	.....	.....

[a] Loss.

Table 11 shows the most profitable and the least profitable plant, for an average yearly period, on a percentage basis. The first plant shows a final profit of 35.16 and the second 5.35 per cent on a net sales basis. The greatest difference in this, as in the two preceding tables showing the most and the least profitable years, is between the percentages for pay roll. The first plant shows pay roll as 17.89 and the second 42.30 per cent on a net sales basis, and 27.15 and 44.17 per cent on a total cost basis.

TABLE 11.—PERCENTAGE OF COST OF EACH SPECIFIED ITEM OF EXPENSE AND PROFIT, BASED ON NET SALES AND ON TOTAL COST, FOR THE MOST PROFITABLE PLANT AND THE LEAST PROFITABLE PLANT FOR THE AVERAGE YEAR.

Items.	Percentage on net sales.		Percentage on total cost.	
	Most profitable plant.	Least profitable plant.	Most profitable plant.	Least profitable plant.
Materials	37.82	42.77	57.40	44.65
Pay roll (salaries and wages)	17.89	42.30	27.15	44.17
Royalties	1.19	.69	1.81	.72
Repairs	2.47	3.98	3.75	4.16
Insurance	.12	.19	.18	.20
Taxes	.77	1.27	1.17	1.32
Selling expense	2.25	1.98	3.41	2.07
Administrative expense	3.31	2.60	5.02	2.71
Miscellaneous	.07	.....	.11	.....
Total cost	65.89	95.78	100.00	100.00
Net sales	100.00	100.00	.....	.....
Manufacturing profit	34.11	4.22	.....	.....
Interest and dividends on outside investments, etc., received	1.41	2.56	.....	.....
Other miscellaneous receipts	.25	.28	.....	.....
Total	35.77	7.06	.....	.....
Less interest and miscellaneous payments	.61	1.71	.....	.....
Final profit	35.16	5.35	.....	.....

Table 12 summarizes the final profits as shown in the preceding tables.

TABLE 12.—THE FINAL PROFIT OF THE MOST PROFITABLE AND THE LEAST PROFITABLE PLANTS FOR THE MOST PROFITABLE YEAR, THE LEAST PROFITABLE YEAR, AND THE AVERAGE YEAR, BY PERCENTAGES BASED ON NET SALES.

Plants.	Most profitable year.	Least profitable year.	Average year.
Most profitable	39.07	34.68	35.16
Least profitable	13.30	[a] 17.42	5.35

[a] Loss.

It is interesting to note that the most profitable plant varied but little in the percentage of final profit from the most profitable to the least profitable year, while the least profitable plant varied from a profit of 13.30 per cent to a loss of 17.42 per cent.

The table which follows summarizes the pay roll in the same way on the basis of total cost.

TABLE 13.—PAY ROLL OF THE MOST PROFITABLE AND THE LEAST PROFITABLE PLANTS FOR THE MOST PROFITABLE YEAR, THE LEAST PROFITABLE YEAR, AND THE AVERAGE YEAR, BY PERCENTAGES BASED ON TOTAL COST.

Plants.	Most profitable year.	Least profitable year.	Average year.
Most profitable	26.47	37.35	27.15
Least profitable	48.53	53.66	44.17

This table shows that the most profitable plant has a lower per cent for pay roll than the least profitable plant, and that this difference is so great that the larger part of the difference in profits can be directly traced to this source, even allowing for the fact that the most profitable plant purchased many of its castings.

RECAPITULATION FOR ALL PLANTS FOR NINE-YEAR PERIOD.

Table 14 gives a comprehensive view of the industry for the entire period from 1906 to 1914, showing the combined figures of the three firms which make 80 to 90 per cent of the cotton-spinning machinery manufactured in this country. Some of the plants closed their books January 1. It was easy to put their figures in the proper yearly column, but in other plants books were closed April 1. In such cases the year ending April 1 was put under the preceding calendar year, to which, of course, the larger part of the fiscal year belonged. For certain years the figures of some plants covered several months, more or less, than the regular yearly period. These figures were decreased or increased, as the case demanded, to bring them to the proper yearly basis. For the year 1914 four plants were raised from six months to a year by doubling the figures.

This table is not given to show the actual figures over the nine-year period, but to give an indication of conditions from year to

year, which it does very satisfactorily. The only change made that could materially affect the figures is the above-mentioned change for the year 1914.

TABLE 14.—SPECIFIED ITEMS OF EXPENSE AND PROFIT FOR THE THREE FIRMS COMBINED, FOR EACH YEAR FROM 1906 TO 1914.

Items.	1906	1907	1908	1909	1910
Materials used	$4,337,403	$4,307,303	$3,550,922	$4,698,743	$4,512,587
Pay roll (salaries and wages)	3,183,221	3,617,016	2,834,989	4,186,749	4,063,479
Royalties	224,592	174,437	99,217	105,762	95,382
Repairs	181,793	180,062	137,709	163,591	127,585
Insurance	7,888	10,278	7,236	12,822	10,871
Taxes	75,262	85,427	104,360	118,610	94,741
Selling expense	373,550	279,454	301,080	331,987	339,646
Administrative expense	161,233	197,397	180,878	231,717	243,728
Miscellaneous	29,778	37,923	29,179	42,697	39,106
Total cost	8,572,723	8,886,297	7,245,570	9,892,708	9,527,125
Net sales	10,845,818	11,513,044	8,622,966	12,837,892	12,803,814
Manufacturing profit	2,273,095	2,626,747	1,377,396	2,945,184	3,276,689
Interest, dividends on outside investments, etc., received	200,747	259,126	342,596	378,421	377,115
Other miscellaneous receipts	119,053	124,935	111,714	92,703	79,280
Total	2,592,895	3,010,808	1,831,706	3,416,308	3,733,084
Less interest and miscellaneous payments	223,654	254,063	167,513	201,098	177,505
Final profit	2,369,241	2,756,805	1,664,193	3,215,210	3,555,579

Items.	1911	1912	1913	1914
Materials used	$2,925,760	$3,356,254	$2,838,943	$2,455,324
Pay roll (salaries and wages)	3,023,140	3,508,113	3,391,081	3,174,198
Royalties	83,299	70,469	36,583	29,187
Repairs	102,689	104,946	83,655	62,382
Insurance	8,026	12,172	21,932	22,623
Taxes	121,354	103,860	135,874	143,875
Selling expense	340,827	332,957	368,893	333,507
Administrative expense	225,183	255,523	229,153	210,330
Miscellaneous	48,598	57,128	52,362	39,400
Total cost	6,878,876	7,801,422	7,158,476	6,470,826
Net sales	8,848,787	8,784,222	7,440,916	6,988,178
Manufacturing profit	1,969,911	982,800	282,440	517,352
Interest, dividends on outside investments, etc., received	298,158	256,007	275,646	296,572
Other miscellaneous receipts	77,142	86,011	84,776	82,966
Total	2,345,211	1,324,821	642,862	896,890
Less interest and miscellaneous payments	144,874	184,212	224,668	210,885
Final profit	2,200,337	1,140,609	418,194	686,005

NET SALES.

From the figures for net sales it appears that in each of the years 1906 and 1907 over $10,000,000 worth of machinery was sold. Then the net sales dropped off to $8,622,966 for 1908, while in both 1909 and 1910 they showed an increase to more than $12,800,000. The years 1911 and 1912 showed net sales of practically the same as 1908 with $8,848,787 and $8,784,222, respectively. The year 1913 shows a decline, with net sales at $7,440,916, and 1914 shows only $6,988,178.

The years 1909 and 1910 show the highest final profit, with a steady decline from those years to 1913, after which there was an increase over 1913.

The decline of profits during recent years is perhaps due more to lower selling prices than to the decreased volume of sales. The years 1911 and 1912 are good examples of this. Net sales for 1911 were $8,848,787, with a final profit of $2,200,337, while 1912 had net sales of $8,784,222 and a final profit of only $1,140,609, approximately one-half of the profit for the preceding year. Materials used for 1911 were $2,925,760 and for 1912, $3,356,254. It is an acknowledged fact that the cost of materials did not change to any marked extent at this time. Therefore more machinery must have been manufactured in 1912 than in 1911, the prices, however, materially declining with a corresponding reduction in net sales.

A convenient method of estimating changes in price is used by one of the plants. Constant prices for the various machines are assumed for the whole period, and these are applied to the number of machines of each kind sold annually. The result shows for each what the net proceeds would have been if the assumed prices had been in force, and comparison of the result so calculated with the actual net sales indicates whether actual prices are on the whole higher or lower than the average. The returns for the one plant (Table 15), which are doubtless typical for the whole industry, disclose a rise in price from 1904 to 1907, and then, except for a slight upward movement in 1910 and 1913, a continuous fall in price to 1914.

TABLE 15.—VARIATIONS IN PRICE OF NEW MACHINERY SOLD BY ONE PLANT, 1904 TO 1914.

[100=constant prices on which the comparison is based.]

Years.	Relative price.	Years.	Relative price.
1904	86.25	1910	99.58
1905	94.67	1911	99.29
1906	104.24	1912	85.53
1907	112.81	1913	87.68
1908	110.74	1914	81.06
1909	99.51		

Using these percentages to explain the decrease in final profit for the year 1912, we find in the preceding table that the selling prices were on a basis of 99.29 per cent of the constant value for the year 1911 and on a basis of 85.53 per cent for the year 1912.

TABLE 16.—NET SALES ON CONSTANT VALUATION BASIS FOR THE YEARS 1911 AND 1912.

Years.	Net sales.	Per cent.	Constant valuation.
1911	$8,848,787	99.29	$8,912,062
1912	8,784,222	85.53	10,027,022

It appears from the above figures that the production of machinery in 1912 was $1,114,960 more on the constant valuation basis than in 1911. This machinery actually sold, however, for $64,565 less than the smaller amount produced during 1911. The final profit for 1912

was $1,059,728 less than for 1911, practically the exact difference in selling price after allowing for the fact that the sales basis in 1911 was a fraction of 1 per cent below the standard valuation.

COSTS.

Table 17 gives the combined cost figures of the three firms for the period 1906 to 1914 by percentages based on net sales.

TABLE 17.—PERCENTAGE OF COST OF EACH SPECIFIED ITEM OF EXPENSE AND PROFIT, BASED ON NET SALES FOR THE THREE FIRMS COMBINED, FOR EACH YEAR FROM 1906 TO 1914.

Items.	1906	1907	1908	1909	1910	1911	1912	1913	1914
Materials used	39.99	37.41	41.18	36.60	35.24	33.06	38.21	38.15	35.14
Pay roll (salaries and wages)	29.35	31.42	32.88	32.61	31.74	34.17	39.94	45.57	45.42
Royalties	2.07	1.49	1.15	.82	.75	.94	.80	.49	.42
Repairs	1.68	1.56	1.60	1.28	1.00	1.16	1.20	1.12	.89
Insurance	.07	.09	.08	.10	.09	.09	.14	.30	.32
Taxes	.68	.74	1.21	.92	.74	1.37	1.18	1.83	2.06
Selling expense	3.41	2.43	3.49	2.59	2.65	3.85	3.79	4.96	4.78
Administrative expense	1.49	1.72	2.10	1.81	1.90	2.55	2.90	3.08	3.01
Miscellaneous	.27	.33	.34	.33	.30	.55	.65	.70	.56
Total cost	79.01	77.19	84.03	77.06	74.41	77.74	88.81	96.20	92.60
Net sales	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Manufacturing profit	20.96	22.81	15.97	22.94	25.59	22.26	11.19	3.80	7.40
Interest and dividends on outside investments, etc., received	1.85	2.25	3.97	2.95	2.94	3.37	2.92	3.70	4.24
Other miscellaneous receipts	1.09	1.09	1.30	.72	.62	.87	.97	1.14	1.19
Total	23.90	26.15	21.24	26.61	29.15	26.50	15.08	8.64	12.83
Less interest and miscellaneous payments	2.06	2.20	1.94	1.57	1.38	1.63	2.10	3.02	3.01
Final profit	21.84	23.95	19.30	25.04	27.77	24.87	12.98	5.62	9.82

Table 18 gives items of cost for the three firms by percentages based on a total cost. A better comparison is obtained from percentages based on total cost than from those based on net sales, because of the fluctuations of selling prices. This table shows that the percentage for materials has gradually declined, while the percentage for pay roll has gradually increased. The decline in materials has been 12.65 per cent of total cost and the increase of pay roll 11.92 per cent.

This change in proportionate costs represents a natural desire on the part of all manufacturers to purchase as little manufactured or semimanufactured stock as possible and to manufacture as many parts in their own plants as their facilities permit. From time to time they have added to their facilities and increased in proportion the number of parts they manufacture. A typical example of this is one large plant which formerly purchased many of its spindles and spinning rings and all of its fliers, but at present makes them all at its own plant. This naturally decreases the percentage for materials and increases the percentage for pay roll.

TABLE 18.—PERCENTAGE OF COST OF EACH SPECIFIED ITEM OF EXPENSE, BASED ON TOTAL COST, FOR THE THREE FIRMS COMBINED, FOR EACH YEAR FROM 1906 TO 1914.

Items.	1906	1907	1908	1909	1910	1911	1912	1913	1914
Materials used	50.60	48.47	49.01	47.50	47.37	42.53	43.02	39.66	37.95
Pay roll (salaries and wages)	37.13	40.70	39.13	42.32	42.65	43.95	44.97	47.37	49.05
Royalties	2.62	1.93	1.37	1.07	1.00	1.21	.90	.51	.45
Repairs	2.12	2.03	1.90	1.65	1.34	1.49	1.35	1.17	.96
Insurance	.09	.12	.10	.13	.11	.12	.16	.31	.35
Taxes	.86	.96	1.44	1.20	.99	1.76	1.33	1.90	2.22
Administrative expense	4.36	3.15	4.16	3.36	3.57	4.96	4.27	5.15	5.16
Selling expense	1.88	2.22	2.49	2.31	2.56	3.27	3.27	3.20	3.25
Miscellaneous	.34	.42	.40	.43	.41	.71	.73	.73	.61
Total cost	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

LABOR COST OF TWO STANDARD UNITS.

Though the wage rates in this industry have increased, it is doubtful whether the unit cost of labor has increased. More efficient manufacturing methods, the use of automatic machines, etc., have probably more than offset any increase in wages.

A good example of this is the cost of labor for each of two standard units of production, as ascertained from the books of one plant, as follows:

TABLE 19.—LABOR COST AT ONE PLANT OF EACH OF TWO STANDARD UNITS, AND NUMBER PRODUCED.

Years.	First standard unit.		Second standard unit.	
	Labor cost per unit.	Units manufactured.	Labor cost per unit.	Units manufactured.
1905	$10.83	1,814	$84.50	1,586
1906	8.87	2,148	83.68	1,602
1908	11.35	1,431	100.11	1,200
1910	7.90	4,245	85.23	2,463
1913	9.96	2,024	97.65	1,170
1914	9.96	1,751	90.88	1,105

As these figures for labor cost are obtained by dividing the total labor cost of each department by the number of units produced they are materially affected by the fluctuation in production. The table shows that the labor cost for the first unit is less for the year 1914 than for 1905, though the production during 1914 was slightly less than during 1905. This would indicate that the advance in wage rates has not increased the actual labor cost on this unit. Comparing the labor cost of the second unit for the same years we find that it is higher for 1914 than for 1905, but that for 1914 the production was materially less than for 1905 which would materially increase the labor cost per unit as shown in the table. If, however, 1914 is compared with 1908, two years when the volume of production was more nearly equal, we find that the labor cost per unit for 1914 was decidedly less than for 1908.

ASSETS AND LIABILITIES.

Table 20 shows the combined assets and liabilities of the three firms considered in this report. These figures were obtained from the annual asset and liability sheets made up by the several firms from year to year, and are the figures at which these items were carried on their books. Two of these three firms expressed themselves as being satisfied with the valuation as taken from their books, while the third stated that they considered that the figures shown by their books were too low.

One of the most interesting items shown by this table is mill stocks and bonds, which is $993,012 in 1906 and has increased to $2,235,343 in 1914. These have been taken as part payment or payment in full for machinery. The amount on hand at any time, however, does not represent the amount of such securities that has been actually accepted, some having been sold and others disbursed as dividends.

Buildings and machinery have increased slightly over $1,800,000 during the period; inventory slightly over $500,000; and bills receivable have decreased $1,163,341. Capital stock (common) has increased from $3,035,745 to $3,550,000, while preferred stock has increased from $400,000 to $3,650,000, or $3,250,000; surplus from $3,555,046 to $5,995,945; reserve accounts (all) have decreased from $1,999,960 to $166,729; bills payable have decreased $849,847; and bonds in 1906 were $974,899, while in 1914 this item was nothing. The total assets and liabilities were highest in 1910, one of the best years, and lowest in 1906 when business was not nearly as good.

TABLE 20.—COMBINED ITEMS OF ASSETS AND LIABILITIES FOR NINE YEARS, OF THE THREE FIRMS MANUFACTURING BETWEEN 80 AND 90 PER CENT OF THE PRODUCTION OF COTTON-SPINNING MACHINERY OF THE UNITED STATES, 1906 TO 1914.

Items.	1906	1907	1908	1909	1910
ASSETS.					
Buildings and machinery	$4,163,764	$4,573,407	$4,869,573	$5,309,972	$5,644,973
Inventory	1,549,145	1,970,742	1,891,987	1,983,648	2,035,387
Bills receivable	4,929,310	5,657,142	4,847,580	5,254,834	5,105,924
Mill stocks and bonds	993,012	1,097,156	1,521,618	1,781,004	2,069,596
Cash on hand and in banks	396,045	343,529	1,103,544	1,085,894	2,194,139
Tenements	557,721	678,633	722,638	753,571	880,835
Miscellaneous	503,088	505,523	495,951	485,323	487,709
Total assets	13,092,115	14,826,132	15,452,891	16,654,246	18,418,533
LIABILITIES.					
Capital stock, common	3,035,745	3,035,745	3,035,745	3,035,745	3,035,745
Capital stock, preferred	400,000	400,000	400,000	400,000	400,000
Surplus	3,555,046	4,626,113	5,885,487	6,913,913	8,811,270
Reserve accounts (all)	1,999,960	2,664,150	3,009,573	3,301,900	3,403,882
Bills payable	3,105,077	3,051,759	2,119,350	1,999,774	1,705,021
Bonds	974,899	974,899	974,899	974,899	974,899
Miscellaneous	21,388	73,466	27,837	28,015	87,716
Total liabilities	13,092,115	14,826,132	15,452,891	16,654,246	18,418,533

TABLE 20.—COMBINED ITEMS OF ASSETS AND LIABILITIES FOR NINE YEARS, OF THE THREE FIRMS MANUFACTURING BETWEEN 80 AND 90 PER CENT OF THE PRODUCTION OF COTTON-SPINNING MACHINERY OF THE UNITED STATES. 1906 TO 1914—Continued.

Items.	1911	1912	1913	1914	Average.
ASSETS.					
Buildings and machinery	$4,642,591	$5,429,660	$5,979,991	$5,980,008	$5,177,105
Inventory	1,871,756	2,541,223	2,454,912	2,060,089	2,039,876
Bills receivable	4,640,726	4,426,099	3,829,117	3,765,999	4,717,418
Mill stocks and bonds	2,231,539	3,101,682	2,572,485	2,235,343	1,955,934
Cash on hand and in banks	1,439,547	553,713	647,173	632,591	932,908
Tenements	909,418	1,053,071	892,939	900,000	816,536
Miscellaneous	469,349	101,067	86,395	61,223	355,070
Total assets	16,204,926	17,206,515	16,463,012	15,635,253	15,994,847
LIABILITIES.					
Capital stock, common	3,835,745	3,800,000	3,550,000	3,550,000	3,323,830
Capital stock, preferred	.....	3,650,000	3,650,000	3,650,000	1,438,889
Surplus	9,262,256	6,858,185	5,910,944	5,995,945	6,424,351
Reserve accounts (all)	897,554	362,046	635,117	166,729	1,826,768
Bills payable	2,156,856	2,530,200	2,709,180	2,255,230	2,403,605
Bonds	38,577	.....	.....	.....	545,897
Miscellaneous	13,938	6,084	7,771	17,349	31,507
Total liabilities	16,204,926	17,206,515	16,463,012	15,635,253	15,994,847

PROFITS.

In the foregoing chapters, treating the items of establishment receipts and disbursements, each plant has been considered as a separate unit. When discussing profits it is necessary, however, that the firm rather than the plant be used as the unit. Two of the firms studied have each only one plant, the third has four plants. The impossibility of apportioning accurately the different items of assets and liabilities prohibited the consideration of these four plants as separate units for this purpose.

When discussing profits it is well to remember that the percentage of profit on net sales does not represent the percentage of profit on the invested capital. In some industries an investment of $100,000 may produce a volume of net sales amounting to $200,000 or $300,000. If such be the case, a profit of 5 per cent on net sales would in reality be a proportionately higher rate on the invested capital. In industries where conditions are different an investment of $100,000 might produce a volume of sales amounting to only $50,000. In such case a profit of 5 per cent on net sales would be proportionately less on the capital invested.

In this industry the investment per dollar of sales is high and only under the most favorable circumstances is the volume of sales for any one year greater than the invested capital. During an average or a low year the volume of sales will be found less than the invested capital. The foregoing tables have shown percentages of manufacturing and final profit on the net sales basis. This perhaps might be confusing unless the tables showing the percentages of profit on invested capital be also studied. The following table (Table 21) gives the different percentages of manufacturing and final profit by individual firms on both capital invested and net sales.

The percentages are figured on capital stock, common and preferred, plus surplus. Ordinarily this would be considered the amount of

invested capital. Normally the combined capital stock and surplus represent the amount owned by the stockholders of the company. Reserve accounts are generally set up to be used for definite purposes, as, for instance, to provide for depreciation or certain losses that are expected to occur. Going carefully over the accounts of the different plants it was found, however, that the reserve accounts set up were, for all practical purposes, simply a division of the surplus account. In most instances, though designated for specific purposes, they were not used for those purposes. It would therefore seem only fair in determining the amount of capital actually invested that these reserve accounts be considered as part of it. This also brings to a true valuation certain of the accounts of one firm which were carried on the books at a depreciated value.

The percentages of profit in the tables showing the combined figures of the three firms have also been figured on capital stock, common and preferred. In the tables showing the plants separately this column has been omitted for the reason that the publication of these figures would clearly identify one of the firms.

TABLE 21.—PERCENTAGES OF MANUFACTURING PROFIT AND FINAL PROFIT ON SPECIFIED ITEMS OF CAPITAL EMPLOYED AND NET SALES, BY SEPARATE ESTABLISHMENTS, FOR THE MOST PROFITABLE, THE LEAST PROFITABLE, AND THE AVERAGE YEAR.

Percentages based on—	Manufacturing profit.			Final profit.		
	Most profitable year.	Least profitable year.	Average year.	Most profitable year.	Least profitable year.	Average year.
Capital stock (common and preferred) and surplus:						
Firm A	43.20	0.52	20.44	48.54	0.21	22.28
Firm B	28.70	1.39	13.31	31.40	2.88	14.96
Firm C	31.43	3.89	15.18	33.04	6.39	16.93
Capital stock (common and preferred), surplus, and reserves:						
Firm A	25.58	.49	14.99	28.74	.19	16.34
Firm B	28.70	1.39	13.31	31.40	2.88	14.96
Firm C	24.13	3.89	13.27	25.37	6.39	14.81
Net sales:						
Firm A	22.69	.70	15.97	25.48	.28	17.41
Firm B	27.55	3.24	19.82	30.14	6.71	22.28
Firm C	27.94	11.64	23.40	29.37	19.13	26.11

In studying these profit tables it is well to have clearly in mind the difference between manufacturing and final profit. Manufacturing profit is obtained by subtracting total cost from net sales. This includes all the costs of manufacturing, together with selling and administration expenses, but it does not include any items of interest either paid or received, or any miscellaneous receipts or rents from tenements and other outside property. Final profit, however, includes the receipts and disbursements of all items of interest paid and received, dividends from outside investments, rents of tenements, and other miscellaneous receipts, and represents the final figures of profit or loss. Dividends or other disbursements to the stockholders of the company are not taken into consideration.

In determining the per cent of profit on invested capital, the total capital stock, common and preferred, surplus and reserve accounts, or in other words the amount actually owned by the stockholders of the company, is the basis. If against this is figured the amount of final profit, the result will be the per cent of profit on the capital in-

vested. Using these figures it is not necessary to consider the amount of borrowed money (bonds or current loans), as the calculation for final profit has taken into consideration the interest paid on such accounts.

Table 22 shows the combined figures of the three firms, percentages being given for both manufacturing and final profit calculated on the several items of invested capital and also net sales. The impression has been current in the industry that it required $2 of investment to produce $1 of net sales. This table shows that for the least profitable year this is true, net sales amounting to 54.13 per cent of the total of capital stock, common and preferred, surplus, and reserves. It does not hold true, however, for either the most profitable or for the average year. Net sales for the most profitable year were 94.04 per cent of the total of combined capital stock, etc. To state this in another way, for the most profitable year one dollar of investment produced slightly more than 94 cents of net sales. Net sales for an average year were 76.70 per cent of combined capital stock, etc., or one dollar of investment produced almost 77 cents of net sales. Borrowed money is not considered as capital invested for the reason that interest charges for same are included as an expense in calculating final profit.

No new capital of any considerable amount has been put into the business during the period covered by this report, capital surplus and reserve accounts having been built up from earnings. The percentage of profit on capital stock, especially for the most profitable year, is large. This is partly due to the fact that one large firm for many years has retained purely nominal figures for capital stock, the larger part of its working capital being carried in surplus account. The large amount of surplus carried by the several firms at different times is perhaps better understood when it is remembered that several of these plants were organized prior to 1840. Whether a firm carries its working capital as capital or surplus in most cases is largely a matter of bookkeeping. For this reason in determining the per cent of profit it is safer to consider capital plus surplus and reserves instead of capital alone as the basis.

TABLE 22.—CAPITAL EMPLOYED, NET SALES, MANUFACTURING PROFIT, AND FINAL PROFIT FOR THREE FIRMS COMBINED, SHOWING PERCENTAGES OF PROFIT BASED ON EACH ITEM.

Items.	Most profitable year.			Least profitable year.			Average year, 1906–1914.		
	Amount.	Manufacturing profit.	Final profit.	Amount.	Manufacturing profit.	Final profit.	Amount.	Manufacturing profit.	Final profit.
		Per ct.	*Per ct.*		*Per ct.*	*Per ct.*		*Per ct.*	*Per ct.*
Capital stock (common and preferred)	$3,435,745	85.72	93.58	$7,200,000	3.92	5.81	$4,762,719	38.33	42.43
Capital stock (common and preferred) and surplus	10,349,658	28.46	31.07	13,110,944	2.15	3.19	11,187,069	16.32	18.07
Capital stock (common and preferred), surplus, and reserves	13,651,558	21.57	23.55	13,746,061	2.05	3.04	13,013,837	14.03	15.53
Net sales	12,837,892	22.94	25.04	7,440,916	3.80	5.62	9,981,711	18.29	20.25
Manufacturing profit	2,945,184	.....	.....	282,440	.....	.....	1,825,743	.....	.....
Final profit	3,215,210	.....	.....	418,194	.....	.....	2,020,929	.....	.....

CHAPTER III.

COTTON-MILL EQUIPMENT.

COTTON TEXTILE MACHINES AND THEIR USES.

The following cotton-mill machinery is in common use in American cotton mills at the present time, and, except automatic looms, is manufactured by the machinery plants considered in this report.

OPENERS.

For the purpose of obtaining uniformity of stock, the bales of raw cotton from different soils and centers of production, after arrival at the mill, are opened and the various grades of cotton, which may vary in length, strength, cleanliness, and color, are mixed.

The mixing was formerly a hand operation, and this slow and laborious method is still in use in a number of mills, but in well-equipped mills the following or similar machinery is in use: (1) Combined bale breakers and feeders, (2) feed tables with mouths, (3) condenser, (4) fan and counter, (5) automatic distributing apron, (6) conducting pipe.

The matted cotton as it comes from the bale is separated by the bale breaker, and after passing through this machine and other mixing operations, which free the cotton from dirt, seed, and other foreign substances, it is fed automatically from the opening machine to the breaker lapper or picker.

PICKERS.

In the picking room of a modern mill the following machinery is in use: (1) Automatic self-feeding breaker pickers, (2) beater intermediate lapper pickers, (3) beater finisher lapper pickers.

From the opening machinery the cotton passes to the breaker pickers, where it is beaten, passed between rolls, made into a lap or sheet about half an inch thick and about 40 inches wide. The breaker picker removes the heavy foreign matter, such as dirt, pieces of cotton seed, etc., separates the tufts of cotton for easier manipulation, and rolls the lap on a bar into the form of a cylinder.

The intermediate and finisher lappers carry on the same processes as the breaker pickers and each successive lap is cleaner and more uniform in its composition. The finisher lapper has an evener attachment which can be adjusted to deliver "card laps" of any weight per yard that is required. The picker-room machinery has been greatly improved since 1860.

When fine yarns are made, combing machines are also used.

CARDS.

The cards, or carding engines as they are called in England, are the most important part of cotton textile machine equipment for yarn production, and the most expensive in the aggregate.

The card lap from the finisher lapper consists of cotton fibers crossed in all directions, and adhering to the fibers are lighter impuri-

ties, such as pieces of leaf, seed, or stalk, which the pickers can not remove. The lap unwinds into the card and the fiber is carried forward on the surface of the wire with which the revolving card cylinder is clothed, and brought into contact with similar wire on top flats revolving more slowly in the opposite direction, thus brushing or carding the material.

The card accomplishes several objects. It removes the small and lighter impurities, disentangles the tufts of crossed fibers and begins the work of making them parallel, changes the lap into a sliver or rope formation, and reduces the weight per yard. The carded cotton is stripped from the main cylinder by a smaller one, which in turn is stripped of its product by a comb. The cotton then passes through rolls and is coiled into cans. The loose, untwisted rope thus formed is called "card sliver."

Before the introduction and manufacture of the revolving top flat card in the United States in 1883, the card in common use was the stationary top flat or Wellman card, named after an American who improved the flat card in the fifties by the use of a device for automatically stripping the flats. This card, which had a wooden frame, continued in use until a recent period, but is now almost entirely replaced by the revolving top flat card built entirely of iron and steel, and very highly improved. One of the leading manufacturers of cotton cards, who took up in 1891 the manufacture of revolving flat cards patterned after those of English build, states that since that date his firm has made use of the patented devices of several different inventors.

The following table shows the production of card sliver in a day of 10 hours by an up-to-date revolving flat card compared with that of the stationary flat card in use in 1883.

The speed of the doffer, it will be noted, is practically the same for the old and new types of machines, but the diameter of the old style doffer was but $15\frac{3}{4}$ inches while in the modern type it is $27\frac{3}{4}$ inches.

TABLE 23.—COMPARISON OF OUTPUT PER 10-HOUR DAY OF OLD AND NEW STYLE CARDS.

1883			1914		
Revolutions of doffer per minute.	40-grain sliver.	70-grain sliver.	Revolutions of doffer per minute.	40-grain sliver.	70-grain sliver.
	Pounds.	*Pounds.*		*Pounds.*	*Pounds.*
7.5	31.82	55.69	7.88	68.81	120.42
8	33.94	59.36	.....	.....	.....
8.5	36.85	63.08	8.48	74.04	129.56
9	38.18	66.81	9.09	79.37	138.91
9.5	40.21	70.50	9.70	84.71	148.24
10	42.12	74.23	.....	.....	.....
10.5	44.54	77.95	10.30	89.33	157.38
11	46.66	81.65	10.91	95.27	166.70
11.5	48.77	85.34	11.52	100.59	176.05
12	50.88	89.04	12.12	105.83	185.20
12.5	53.00	92.76	12.73	111.15	194.51
13	55.14	96.52	13.34	116.48	203.82

In the above table 10 per cent of the time is allowed for cleaning, oiling, and stripping of the 1883 machine, 5 per cent for the same processes in 1914.

DRAWING FRAMES.

The process of disentangling, straightening, and parallelizing the fibers, which has been partly accomplished in the card, is continued by the drawing frame. This machine has four rolls, running at different speeds, and slivers are fed into them, to be drawn into finer slivers, and then a number of those, usually six, united again into a single sliver and coiled into a can. There are either two or three processes of drawing in use according to the kind of yarn desired.

A number of improvements have been made in drawing frames, principally in stop-motion devices, which enable the operative to tend a greater number of machines and also to reduce the labor cost per unit of production.

Until recent years common top rolls were used on drawing frames, but metallic fluted rolls have now largely superseded them. The common top rolls were covered with two layers of leather, the outer thin, tough, and elastic, to avoid damaging the cotton fiber. Revolving at high speed, however, under certain atmospheric conditions and with certain kinds of cotton stock, the leather-covered rolls work badly and yield poor results. The process of making them, moreover, is slow and expensive.

The metallic fluted roll meets these difficulties to a very great extent, and at the same speed the output of machines so equipped is about 20 per cent greater than with the leather-covered rolls.

SLUBBER AND ROVING FRAMES.

From the drawing frame the sliver passes to the slubber, where each sliver is alternated by being passed through three successive pairs of rollers revolving at different speeds, and it is thus wound onto bobbins, a slight twist being inserted during this operation. The product is known as roving or roping to distinguish it from sliver in which there is no twist.

The reduction of the roving to a fineness that fits it for spinning is accomplished by passing it through roving frames, the first of these being known as the "intermediate" and the second as the "fine frame." In some cases there is employed yet another roving frame called the "jack frame." All of these machines are included in the general term "fly frames," because all have a part called a "flyer," which is attached to the spindle and revolves with it.

Other than minor changes in the design of the frame and other details, the only important improvements in the last 25 years are balanced bobbin rails, adopted in 1899, and new features in the design and construction of flyers.

RING SPINNING FRAMES.

Ring spinning, unlike mule spinning, is a continuous process in which the yarn roving is at the same time drawn out, twisted, and wound on bobbins. The spinning spindle and its revolutions are two factors governing the production and progress of the industry.

The ring spinning frame is an American invention which originated in the year 1831. In that year there were 1,246,703 mule spindles in operation in the United States. In 1860 there were 5,235,727 spindles, and about one-half of these were ring spindles. In 1890,

of 14,188,103 active spindles, 62 per cent were ring spindles, and in 1914, of 32,744,012 cotton-producing spinning spindles, 87.3 per cent were ring spindles.

It is said that the cost of the spinning machinery in a cotton mill is probably equal to 20 per cent of the entire cost of the mill ready for operation, and that about one-half of the entire power required to run a cotton mill is necessary to drive the spinning machinery. For these reasons, with others, the spinning department receives the largest share of attention and as a most natural consequence shows the most advance and improvement.

The Sawyer and Rabbeth spindles were the foremost in the ring spinning development from 1872 to 1887 and, with their improvements, are still made by leading manufacturers in addition to the more recent Whitin gravity spindle, the McMullen spindle, the Draper, and the Sherman spindles. About 1860, 5,500 revolutions per minute was high speed, but for several years past this speed has been more than doubled. One concern says of its best spindle: "Some of the spindles have been run at a speed of 12,000 turns a minute for several years without any perceptible evidence of wear." From 1870 to 1903, 373 patents have been taken out on ring spindles in the United States, and one manufacturing concern states that in the last 25 years 48 patents have been granted covering improvements on ring spinning frames.

Table 24 compares the production of warp yarn from numbers 10, 20, 30, 40, and 50 upon a ring spinning frame of the present day and that of a ring spinning frame producing the same numbers in 1883.

In this table the production per spindle at 12,000 revolutions per minute is not shown, as the comparative data were not available. The highest speed shown is 9,700 revolutions as compared with 6,500, 30 years ago. The table shows that the increase in production of yarn per spindle of the specified numbers ranges from 53.47 per cent to 61.76 per cent.

As the length of the frame has been increased and the operative enabled to attend more spindles than formerly, with the increase in speed it is probable that the output per spinner has been doubled.

TABLE 24.—COMPARISON OF PRODUCTION OF SPINNING FRAME, RING WARP YARN, 1883 AND 1914.

Warp yarn.	Twist per inch.		Revolutions of front roll per minute.		Revolutions of spindles per minute.		Hanks per day per spindle.		Pounds of yarn per day per spindle.		Increase in production.
	1883	1914	1883	1914	1883	1914	1883	1914	1883	1914	
											Per ct.
No. 10.....	15.02	15.02	110.2	153.6	5,200	7,250	5.904	8.530	0.590	0.953	61.53
No. 20.....	21.24	21.24	89.9	134.0	6,000	8,950	4.902	7.525	.245	.376	53.47
No. 30.....	26.01	26.02	73.4	116.2	6,000	9,500	4.073	6.598	.136	.220	61.76
No. 40.....	30.04	29.07	66.7	106.2	6,300	9,700	3.766	6.097	.094	.152	61.70
No. 50.....	33.58	32.52	62.6	94.9	6,500	9,700	3.533	5.508	.071	.110	54.93

COMBING MACHINES.

Combing machines are used for producing finer grades of sliver for very fine yarns, and also for a high grade of yarn of coarse numbers. They comb the fibers and take out the shorter ones, combed

yarns being the resultant product, as distinct from yarns that have been carded only and are called carded yarns.

A complete combing-machine equipment includes a sliver lap machine, a ribbon lap machine, and the combing machine. The first makes the lap from a number of card slivers; the second combines several laps from the sliver lap machine into a single lap of a required firmness and evenness; the comber takes out all the short fibers.

While English manufacturers have perfected combing machinery and English cotton mills make a greater proportion of fine yarns than those in the United States, it was in France that this machinery was invented, by Heilmann, in 1845. English combing machines had practically an exclusive market in the United States up to 1897, as combers were not made here. A leading American cotton textile manufacturer thus describes the origin and progress of American-made combers:

> In 1896 we began the manufacture of combing machinery, comprising sliver lap, ribbon lap, and combing machines. The first machines were duplicates of English-built machines such as had been made in England for many years with very few improvements since first invented by Heilmann in 1845. From the first we found this machinery handicapped on account of low productive capacity and consequent high labor costs. To overcome this defect many ideas were thought out, experimented with, and some were incorporated in the machine's construction as it stands to-day, capable of producing 150 per cent more combed cotton than the old machines.

These machines are protected by 18 different patents, granted since 1903. The manufacturer says further:

> Other improvements are covered by pending patents. Most of the improvements in all of our machines have resulted in increasing the productive capacity of the machine to which they are applied, and at the same time afforded means whereby the mechanisms were simplified to such an extent that the operative was enabled to tend more machines and thus decrease the labor cost per pound of production.

AUTOMATIC LOOMS.

In 1894 the automatic loom was perfected and placed in practical operation. It differed from the plain loom in that the machine did not have to be stopped for the purpose of taking out the empty bobbin and replacing it with a full one, thus saving, it is estimated, from 100 to 200 stops a day. The automatic loom has "a bobbin-changing device, a filling hopper from which bobbins or cops are automatically transferred to the loom shuttle, a peculiar shuttle which can be threaded automatically by the motion of the loom, devices that act to stop the loom if the shuttle is not in position, and a warp stop motion to prevent the making of poor cloth."

From 6 to 12 plain looms may be attended by one weaver, while from 14 to 28 automatic looms need but one person to keep all of them in continuous production. Moreover, from the records obtained in 1911–12 it is shown that eight plain looms, which were attended by one weaver, produced 30.33 linear yards of bleached domestic cotton cloth per hour, while a weaver operating 24 automatic looms produced 101.75 linear yards per hour of the same material. In both cloths 60 was the number of picks per inch, the speed of the plain looms being 156 picks and that of the automatic looms 165 picks per minute.[a]

[a] Tariff Board report on cotton manufactures, 1912.

COTTON-WASTE MACHINERY.

The utilization of the waste product of the various cotton-manufacturing processes has engaged the attention of all the principal cotton textile machinery manufacturers. In some mills spinning a low-grade cotton yarn some of the waste is mixed with new cotton and combined in the yarns forming the staple product of the mill. The larger part of the waste produced, however, can not be used in this way, but it is sold to the waste buyers for the export trade. In some cases it is sold directly to waste spinners.

Cotton waste is divided into two classes called hard and soft waste. Hard waste, or waste in which there is some twist, is made on the spinning and succeeding machines, and consists of cop bottoms, reel waste, twister waste, etc. Hard waste has to be run through some machine to tear it up and take out the twist before it can be reworked. It is graded according to clearness, whether white or colored, and according to the machine on which it is made. Soft waste includes all waste of the machines up to the spinning frames, such as motes, card fly, flat and cylinder strips, clearer waste, clean sweepings, oily waste, etc.

There are two principal systems of machinery used in the manufacture of cotton waste, the condenser and the coiler. The first resembles the woolen system and the latter is more like the cotton system. The condenser produces a soft full yarn which can be used for warp and filling for blankets, flannelettes, cleaning cloths, quilts, and such fabrics. The coiler is used where harder-twisted yarns are desired.

Lancashire, England, is the principal center of the hard-waste spinning industry, while Germany and Austria have developed soft-waste spinning to a very high degree. England did import hard waste to be manufactured from both Germany and Austria, while these countries, in turn, imported soft waste from England.

While few American cotton mills use yarns made from waste, during the last few years American manufacturers have developed machines for the utilization of waste, and have been supplying such equipment to a few American spinners. With the advance in the waste-spinning industry, the manufacture of waste machinery will become more important.

The quality of the yarns and fabrics made in Germany from waste or waste mixed with new cotton is surprising to one unfamiliar with the industry. Agents of the Bureau obtained imported samples of the following:

FABRICS MANUFACTURED FROM DIFFERENT CLASSES OF COTTON WASTE.

Sheeting.—Cotton warp; waste filling from coiler or preparation (about 8s from cop bottoms).

Twill sheeting.—Cotton warp; waste filling from condenser yarn (about 8s from cop bottoms), bleached in piece.

Sheeting.—Cotton warp; waste filling from condenser yarn (about 8s from cop bottoms).

Plain sheeting.—Cotton warp; waste filling from condenser yarn (about 8s from cop bottoms).

Plain condenser sheeting.—Raised and finished.

Colored satin quilt.—Cotton warp; waste filling.

Floor cloth.—Jute warp; condenser filling from sweepings.

Sponge cloth.—Cotton warp; preparation or condenser filling waste.
Toweling.—Cotton warp; condenser filling (about 6s from cop bottoms).
Scouring cloth.—Jute and cotton; waste mixed for both warp and filling (about 4s condenser).
Chintz alhambra quilt.—Cotton warp; condenser filling from scutcher waste, sweepings, etc.
Red alhambra quilt.—Cotton warp; condenser filling 2s to 3s from scutcher waste, sweepings, card-room waste, afterwards bleached.
Honeycomb quilt.—Cotton warp; waste filling from scutcher waste, sweepings, and card-room waste, afterwards bleached.
Crêpe cretonne.—Cotton warp; preparation filling (8s from cop bottoms).
Crêpe cretonne.—Cotton warp; preparation filling (about 8s from cop bottoms).

MACHINE EQUIPMENT OF A 50,000-SPINDLE MILL.

The number of different machines required in a cotton mill of 50,000 ring-spinning spindles, making specified numbers of warp and filling and producing the yarn used by 1,359 plain looms in weaving cotton cloth of a specified width and number of threads per inch, is shown in Table 25, which was compiled from cotton-mill architects' specifications in the report of the Tariff Board of 1912. The table also shows the number of operatives required, together with the production per machine or per spindle, and total production per week of 56 hours.

TABLE 25.—REQUIRED MACHINE EQUIPMENT AND MACHINE OPERATIVES OF A PRINT-CLOTH COTTON SPINNING AND WEAVING MILL OF 50,000 SPINDLES AND 1,356 PLAIN LOOMS, MAKING 32s WARP AND 50s FILLING, CLOTH 32 INCHES WIDE, 64 BY 64 THREADS PER INCH, IN 116-YARD CUTS, WITH THE PRODUCTION IN POUNDS OF EACH MACHINE.

[Compiled from Tariff Board data on cotton textiles based on architects' specifications.]

Machines.	Number of machines.	Spindles.	Kind.	Machine operatives required.	Output, week of 56 hours.		
					Product.	Output per machine or spindle.	Total output.
						Pounds.	*Pounds.*
Opening room: Openers	4	.....	Self-feeders	2 men, opening and feeding	.....	.....	.....
Picker room:							
Breaker lappers	4	.....	40-inch	2 picker hands	12.5-ounce lap	13.563	54,252
Intermediate lappers	5	.....	....do		12-ounce lap	10.343	51,715
Finisher lappers	5	.....	....do		11.5-ounce lap	9.962	49,810
Card room:							
Revolving top flat cards	70	.....	....do	2 grinders, 2 strippers, 4 card boys	45-grain sliver	[a] 716.8	50,176
Drawing frames [b]	15	[c] 180	16-inch metallic rolls	6 drawing-frame tenders	....do	[d] 772.8	139,104
Slubbers	8	512	11 by 5½ inch bobbins	4 slubber tenders	70/100 hank roving	89.6	45,875
For warp yarns:							
Intermediate frames	8	800	9 by 4½ inch bobbins	4 intermediate-frame tenders	1.65 hank roving	33.77	27,016
Fine frames	16	2,560	7 by 3½ inch bobbins	8 fine-frame tenders	4.50 hank roving	10.36	26,522
Ring spinning frames	103	23,072	2⅜-inch gauge	26 spinners	No. 32 yarn	1.12	25,841
Spoolers	10	1,600	4¼-inch gauge	20 spooler tenders	5 by 4 inch spools	[c] 2.9	25,984
Warpers	20	[f] 7,200	With creels for 360 spools each	5 warper tenders, 4 creelers	.....	[g] 230.	25,760
Slashers	4	.....	2 cylinders each	3 slasher tenders, 1 helper	.....	[g] 1.150	25,760
For filling yarns:							
Intermediate frames	6	600	9 by 4½ inch bobbins	3 intermediate-frame tenders	1.80-hank roving	29.06	17,436
Fine frames	14	2,240	7 by 3½ inch bobbins	7 fine-frame tenders	5.70 hank roving	7.5	16,800
Ring spinning frames	121	27,104	2¾-inch gauge	30 spinners	No. 50 yarn	.616	16,696
Plain looms	1,359	.....	32-inch	170 weavers	32-inch prints	[h] 5.6	42,618

[a] Per card.
[b] Two heads per frame of 6 deliveries per head.
[c] Deliveries.
[d] Per delivery.
[e] Per 10 hours, per spindle.
[f] Spools.
[g] Per 10 hours, per machine.
[h] Per 10 hours, per loom.

NOTE.—The above shows 303 operatives employed on producing machinery. Allowing for the operatives in the cloth room, for foremen, loom fixers, day help, etc., including men in the engine and boiler rooms and in the machine and carpenter shops, there is required a total force of 396 employees to run this mill.

The number of machine operatives required is 302 and other employees 69, making a total of 371 employees of all classes.

IMPROVEMENTS IN COTTON-SPINNING MACHINERY.

The following list of patents obtained from the records of the machinery manufacturing establishments will give an idea of the improvements that have been made in cotton-textile machinery in recent years.

PATENTS ON COTTON-SPINNING MACHINERY AND MISCELLANEOUS TEXTILE MACHINERY ISSUED SINCE 1881.

[List obtained from two of the firms covered by this report.]

PICKERS.

1889. Horizontal trunk.
1889. Cotton opener and trunk.
1890. Dust trunks (inclined).
1891. Dust trunks (horizontal).
1892. Leather clearer apron.
1893. Feeder.
1896. Cotton conveyor.
1899. Improvement in evening devices for openers.
1899. Beater lock.
1900. Improvement in lap roll tension for openers.
1901. Improvement in evening devices for openers.
1902. Improvement in cleansing trunks (3 patents).
1905. Pneumatic conveyor second table.
1908. Cotton distributor.

COMBERS.

1903. Stop motion.
1904. Stop motion.
1906. Detaching motion.
1906. Comb motion.
1906. Detaching motion.
1906. Sliver packer.
1907. Comb cylinder clearer.
1907. Stop motion.
1907. Piecing motion.
1908. Stop motion.
1909. Weight reliever.
1911. Lap winder.
1912. Sliver pan.
1912. Nipper frame.
1913. Top comb brush.
1913. Stop motion.
1914. Sliver pan.
1915. Detaching motion.

MISCELLANEOUS.

1894. Band cutter.
1894. Safety stop motion.
1894. Fiber-feeding machine.
1895. Wool washer.
1895. Dryer aprons.
1895. Wool washer.
1895. Trumpet for machine for preparing sliver.
1895. Stop-motion mechanism for machines for preparing sliver (3 patents).
1895. Electric stop motion for machine for preparing sliver.
1900. Coiler head (3 patents).
1900. Warp stop motion for looms.
1903. Coiler head (2 reissues).
1903. Coiler head.
1903. Automatic sprinkler.
1904. Fire extinguisher.
1904. Stop motion for twisting frames.
1904. Machine for preparing and spinning worsted (5 patents).
1906. Cap for spinning and twisting.
1911. Spindle support for spinning, twisting, and the like machines.
1912. Condenser cap machines (5 patents)
1914. Cotton conveyor.
1914. Eveners.
1914. Feeding mechanism.
1890. Yarn-measuring device.
1892. Belt-shipping device.
1896. Stop-motion spoon for machine for preparing sliver.
1896. Means for changing speed for differential gearing.
1899. Spindle guards for textile-treating machines.
1909. Improvement in calender rolls.
1912. Improvement in gear-cutting machine.
1912. Improvement in lap winders.
1912. Improvement in hank clocks, roving and spinning.
1912. Belt shifters.
1912. Flapper for lap winder.
1912. Spindle support for spinning, twisting, and like machines.
1913. Insulation of slasher cylinder.
1914. Safety device for lap winders.
1914. Roll support for spinning, twisting, or like machines.
1914. Fiber-feeding mechanism.
1914. Safety device for lap winding and the like.
1914. Bobbin gear.
1914. Spindle drive for spinning, twisting, or like machines.
1914. Bearing for slide rods for textile machinery.

CARDS.

1881. Improvement in cards.
1885. Improvements in cards.
1889. Improvement in top flat clearers.
1890. Improvement in coilers.
1890. Improvement in stripping mechanism for card.
1890. Carding engine.
1891. Traveling flat carding-engine (4 patents).
1891. Carding engine (2 patents).
1892. Device for supporting and adjusting front and back covers of carding engine.
1892. Grinding mechanism for traveling flats of carding engine (2 patents).
1892. Device for supporting or adjusting screens or undercasings for the cylinders or rollers of carding engines.
1892. Traveling flat carding engine.
1892. Carding engine (4 patents).
1893. Actuating mechanism for doffer combs of carding engine.
1893. Feed-roll weighting device for carding engines.
1893. Actuating mechanism for doffer combs of carding engines.
1893. Improvement in coilers.
——. Improvement in flat grinding.
——. Improvement in stop motion for cards.
1894. Improvement in card grinding.
1894. Improvement in balancing card cylinders.
1894. Improvement for grinding flats.
1894. Protector for the ends of clothing of flats of carding engine.
1894. Carding beater.
1894. Improvement for applying card clothing.
1894. Improvement for grinding edges of flat bars.
1895. Improvement for preparing card clothing.
1895. Improvement in card grinding.
1895. Improvement in stands for carding engines.
1895. Improvement in machines for card grinding.
1896. Improvement in fastening card clothing.
1895. Stripping mechanism for carding chines.
1895. Improvement for grinding cards (2 patents).
1896. Feeding mechanism for carding engines.
1896. Improvement in applying clothing.
1897. Devices for preparing clothing.
1897. Devices for attaching clothing to flats.
1897. Improvement in fastening clothing.
1897. Devices for attaching clips.
1897. Improvement in machines for bending sheet metal.
1897. Grinding mechanism for revolving top flats.
1897. Improvement in fastening clips.
1897. Improvement in card clothing attachment devices.
1898. Guide for flat grinding (2 patents).
1899. Design for end clips.
1899. Improvement in end clips.
1899. Apparatus for grinding for rotary carding engines.
1899. Improvement for flats.
1899. Improvement for grinding cards.
1899. Improvement in cards.
1901. Improvements in guides for grinding flats.
1901. Improvements in flats.
1902. Improvement in card clothing.
1903. Improvement in carding engines.
1904. Improvement in flats.
1904. Improvement for applying card clothing to cylinders.
1912. Improvement in coiler tubes.
1912. Improvement in machines for attaching card clothing to flats.
1912. Revolving mote knives.
1915. Stripping device.

DRAWING.

1883. Improvement in eveners for railways.
1888. Improvements in eveners for railways.
1893. Evener mechanism.
1893. Stop-motion devices for drawing frames.
1893. Stop motion.
1893. Stop motion.
1894. Stop motion.
1895. Improvements in stop motions for railways.
1895. Improvements in machines for drawing and evening sliver.
1895. Improvement in stop motion for railway head.
1895. Improvement in drawing frames.
1897. Improvement in drawing.
1898. Design for sliver-guiding spoon.
1899. Improvement in drawing.
1899. Improvement in railway (2 patents).
1900. Improvement in roll clearers (2 patents).
1900. Gear covers for railway.
1903. Safety device (2 patents).
1905. Improvement in drawing frames and similar machine.
1905. Improvements in drawing frames and the like.
1906. Evener regulator.
1906. Improvements in drawing rolls.
1911. Coiler.
1912. Stop motion.
1912. Sliver guide.
1912. Stop motion (2 patents).
1913. Trumpet.
1914. Trumpet adjuster.
1914. Evener.

ROVING.

1886. Improvement in slubbing and roving frames.
1888. Improvement in spindle tube bearings for roving frames.
1892. Bottom cone device for fly frames.
1892. Mechanism connected with the lifting or traverse rails of fly frames.
1892. Stop motion for fly frames.
1895. Fly frames (2 patents).
1896. Fly frames (3 patents).
1898. Improvement in roving frames.
1899. Lubricating device, roving.
1899. Improvement in speeders.
1899. Improvement in yielding bearing in spindle shaft for roving machines.
1899. Improvement in covering plates for rails, bolsters, or steps in roving machines.
1912. Belt shifters, roving.
1912. Improvement in shaft bushings, roving.
1913. Creel boards, roving.
1913. Casing for roving frame mechanism.
1913. Improvement in couplings for roller beams and the like, roving.
1914. Bobbin gears, roving.
1890–1915. Roving-frame improvements:
1870 model—
Quadrant lifter motion.
Steel gear casings.
Steel clearer covers.
Brass lined roll stands.
Improved builder, with run-over stop motion.
Application of Cook & Harrison traverse motion.
Improved methods of roll covering.
Perfected methods of fluting steel rolls.
Perfected methods of grinding spindles.
Improved outrigger bearing.
Improved bolster rail.
Improved hank clock.
1908 model—Improved new design throughout, embodying the following details:
Improved head end frame with steel paneling, generated tooth gearing throughout, spiral tooth horsehead gearing.
Improved sun wheel.
Improved T-section bolster and step rail.
Improved bolster.
Improved creel supports.
Improved self-aligning bearings.
Improved cone construction, cones made with a ground contour.
Improved cone lifter motion.
Improved roll gearing arrangement.
Improved weight sheave.
Improved rack return motion.
Improved reversing motion.
1890–1915. Roving-frame improvements—Continued.
1908 model—Improved new design throughout, embodying the following details—Continued.
Improved builder.
Improved samson design, embodying thoroughly machined construction.
Frame made more accessible.
All running parts thoroughly protected to prevent accident in operation.
Low drop creel in front, to prevent awkward reaching by operative.
Seat applied for accommodation of operative.
Improved lifter gear train.
Elimination of projecting set screws on running parts.
General improvements to help increase efficiency of operative and ease in handling machine.

SPINNING.

1893. Separator mechanism for ring-spinning frames (2 patents).
1893. Separator mechanism for ring-spinning frames (2 patents).
1893. Separator mechanism for ring-spinning frames (2 patents).
1893. Ring spinning and doubling frame.
1893. Separator mechanism for ring-spinning frames (7 patents).
1893. Fly-frame.
1897. Ring-spinning frame.
1898. Lubricating device for spinning frames.
1899. Lubricating device, spinning.
1899. Improvement in slit-bush bearings for lifting rods, spinning.
1902. Improvement in spinning machines.
1902. Improvement in roving machines
1903. Separator, spinning.
1913. Creel boards, spinning.
1913. Spinning.
1915. Builder motion.
1915. Builder motion, spinning.
1890–1915. Spinning frame improvements:
1870 model—
Improved filling builder.
Improved warp builder.
Improved belt shipper.
Combination roll stand.
Combination frame, new design throughout to accommodate new roll stand.
Double cylinder frame design.
Application of R. C. separator to Biddeford frames.
Application of Cook & Harrison traverse motion to Biddeford frames.
Application of outrigger bearing.

1890–1915. Spinning frame improvements—Continued.
1908 model—Improvement in design throughout, embodying the following details:
Box spindle rail application.
Improved head end frame.
Improved outrigger bearing.
Improved head end and overhead belt shipper.
Improved head end and foot end creel stand.
New combination warp and filling builder.
Application of cut gearing throughout.
Improved cross shaft.
Miscellaneous spindle improvements, including the adaptation of Thompson clutch to McMullan spindles.
Adaptation of Houghton steel thread board.
New design of self-weighted rolls with conical clearer.
Spindle tape drive arrangement complete.
Application of channel iron beam in place of angle iron.
Application of seat for operative.
Belt shipper safety latch.

SPOOLERS.

1891. Yarn cleaner for spooling machine.
1898. Thread guide, spooler.
1901. Improvement in cop holders for spooling machines.

1898–1915. Spooler improvements:
1898 model—
Improved empty bobbin carrier device.
Improved spindles.
Application of various makes of thread guides and bobbin holders.
Application of metal boxes and shelves in place of wood.
Improved traverse motion.
1911 model—Improved new design throughout, embodying the following details:
New geared head end with self-locking sheet metal doors.
Improved adjustable mangle wheel.
Improved thread guide rod setting.
New design of thread guide.
New design of bobbin holder.
New rack traverse motion.
Improved empty bobbin carrier device.
Improved portable side box arrangement.
Tape drive application.
Improved spindle.
Improved samson construction.
Adaptation of clamps and safety set screws.
Lubrication improvements throughout.
Improved belt shipper and pulley guard.
Various improved tension devices.
Complete safety devices.
1880 model—
Improved swift construction.
Improved friction spindle.
Improved stop motion.
Improved doffing arrangement.
1913, 1914, and 1915 model—
Improved steel swift.
Improved all-metal construction.
Improved doffing arrangement.
Improved spindle carrier arrangement.

CHAPTER IV.

MACHINES USED IN MANUFACTURING COTTON-SPINNING MACHINERY.

SHOP EQUIPMENT.

Many automatic machines are used in the cotton-spinning machine shops, especially for small parts, and many special machines, automatic and semiautomatic, are designed and made at the plants. The larger organizations have engineers to study methods and design machinery for reducing costs. One plant of the group considered in this report is recognized as being the most efficient card manufacturing plant in the world in its processes of manufacture. The others, except one, are generally considered by the trade as good.

IMPROVEMENTS.

Great changes have taken place in recent years in the methods used in transforming pig iron, sheet iron, steel, and other raw materials into finished machines. In the foundries of the machine manufacturing shops, hand molding in the making of castings has almost entirely disappeared and machine molding is substituted. In one of the large plants making cotton-carding engines or cards which weigh, completed, over 6,000 pounds each, a number of important improvements have been made in the molding of the castings. The following information was obtained from this plant:

The time saved by machine molding is illustrated by the fact that formerly one man by hand molding made two card sides in a day's work. The two card sides are the largest single pieces in the machine. By the machine-molding methods now in use two men make 10 card sides in one day. The piece price paid for hand molding per card side was $1.12½ and for machine molding it is 59¼ cents per card side. On this basis the hand molder made $2.25 per day, while each of the machine molders earns $2.96 per day.

Another improvement in foundry usage brought about by the adoption of molding machines is that the pattern to be molded is fastened to a machine and drawn from the sand by turning a lever instead of lifting it by hand. Much more uniform work is obtained in this way, and much more work can be done per man in a given time.

While individual earnings have increased, the cost of labor by machine molding has been reduced, as shown in the following list of piece prices for some of the castings:

TABLE 26.—PIECE PRICES FOR CERTAIN CASTINGS MADE BY ONE OF THE LARGE PLANTS WHICH MANUFACTURES COTTON CARDS.

Castings.	Hand molding.	Machine molding.
Arch	$0.5625	$0.28125
Cylinder spiders	.6500	.26000
Doffer spiders	.1600	.10500
Card sides	1.1225	.59250
20-inch pulleys	.3500	.12500
Bench flasks	.0700	.03500

In lathe turning, drilling, milling, tapping, and other machine operations, many very important improvements have been made to increase production and improve the quality of the work.

The card cylinder casting is a large and important part of the completed card. This cylinder is 4 feet 2 inches in diameter and 3 feet 4 inches in width. To turn the cylinder to finished condition, the company above referred to formerly used the best lathes obtainable from the machine-tool shops of the country, and with these was able to cut across the cylinder twice in five hours, using two cutting tools as provided. Lately the same company designed and built in its own shop an especially heavy lathe for this work, by which the machine operator can take the two cuts across the cylinder in one and three-quarters hours, six cutting tools being at work at one time. For card doffers, which are smaller cylinders, 2 feet 3 inches in diameter, and also 3 feet 4 inches wide, this concern designed and built powerful lathes which show similar results in speed and labor cost.

For turning the shafts of the cylinders and doffers, other heavy lathes have been designed and built, with six cutting tools at once instead of two as formerly.

Three pulleys about 20 inches in diameter are used on each card. Formerly these were turned on the regular lathes of the best type ordinarily used in machine shops, the company paying 80 cents each for finishing the pulleys. Heavy lathes in which 5 or 6 tools operate at once have reduced the labor cost per pulley for this work from 80 cents to 35 cents.

In card arches a variety of machine work has to be done, such as drilling, milling, and tapping. The card arches weigh over 100 pounds but in the usual former methods had to be hauled to different machines to have the different kinds of work done. Recently a special machine was devised for doing all the work at once, two sets of milling cutters and a drill each performing their individual work at the same time, with corresponding reduction in time and labor cost.

The card sides have to be finished on machines. This had been done on planers and milling machines. By means of a special milling machine which carries five cutters, more accurate work is now being done in a shorter time.

In one department a series of semiautomatic machines was installed for finishing certain cast-iron pieces, and on that class of work a saving

of 50 per cent of time was made, with a reduced labor cost. Drilling machines of two or three spindles each have been installed, and often a man can tend two or three drills in place of one. The high-speed hard steel which has recently been adopted for drills, milling cutters, and lathe tools has resulted in much faster work than can be done with other kinds of steel.

The superintendent at the plant which furnished this information stated that while the labor cost has been reduced materially it has been to a great extent offset by the heavy expenditures for the inventing, designing, and building of the new appliances.

CHAPTER V.

COST ACCOUNTING AND EFFICIENCY.

PRESENT METHODS.

While much has been done in the last 25 years to increase the manufacturing efficiency of the various cotton-spinning machinery plants by the invention of automatic and other special tools, the cost accounting has been to a great extent neglected. One of the large firms visited was still using a single-entry system for its general books. A smaller firm until 1912 had not taken an inventory of stock on hand for 25 or 30 years.

One of the firms had an excellent and detailed unit factory cost system, but there was no distribution of the items of general expenses, taxes, insurance, and other overhead expenses by the general office, so that while the factory unit costs were complete, a total unit cost could not be shown. This is now being remedied by the installation of a complete unit-cost system.

The other two large concerns had no unit-cost systems. They had, however, the segregated expenditures as shown in this report.

AN EFFICIENCY EXPERIMENT.

One large plant undertook an efficiency experiment in 1912 which, although the firm did not apply the results to its other departments, was so interesting and conclusive that it is worthy of special mention here. A firm of efficiency engineers was called in, and under their direction an important part of a machine, in itself a complete manufacturing unit when finished, was selected as the basis to work upon.

The results were obtained by means of a time study and bonus system, which brought about a reduction of 25 per cent in the labor cost while increasing the production nearly 50 per cent and increasing the earnings of workmen more than 26 per cent. A member of the efficiency firm described the bonus system as follows:

> Most of the gain came through having the work at hand for the men and through the men's own initiative under the spur of an increased wage.
>
> The standard was set with the idea that a good man working consistently for 9 hours out of 10 at his machine or bench could earn 20 per cent in addition to his regular wages, and the bonus began to be paid at 81 per cent of the standard. For example, if a man was being paid $2 per day and he was doing 30 pieces per day, while the stop watch indicated that he could do, without undue effort, 80 pieces, our standard was set at 80 pieces and he was expected to make 64 pieces without additional compensation as being only a fair day's work.
>
> When his production reached 81 per cent of the standard of 80 pieces, he received a bonus of 1 per cent of his wages, and thereafter he received an additional bonus of 1 per cent for each gain of 1 per cent in his productive efficiency. For instance, if he produced 90 per cent of the standard of 80 pieces, he received 10 per cent of his wages additional. If he produced the full standard of 80 pieces, he received 20 per cent. If he produced 10 per cent more than 80, his bonus was 30 per cent, and so on.
>
> In effect this amounts to a slightly diminishing piece rate, with this difference: On piecework a man gets so much a piece for every piece he has done irrespective of what his work may be during the balance of the week. This bonus was computed

over a period covering a week, so that the man was required to sustain his effort and not merely work in spurts. For example, if his efficiency on Monday was 110 per cent and on Tuesday dropped to 80 per cent, his average for the two days would be 95 per cent.

The standard was obtained by observation of actual work done with the use of a stop watch. Where more than one man was doing the operation, studies of each individual were made. The whole operation was first divided arbitrarily into so-called unit motions.

For example (*a*) picking up piece from floor or bench; (*b*) putting piece in machine; (*c*) machine operation; (*d*) removing piece from machine; (*e*) inspection of piece by operative. Time allowances under the bonus system are made to the men on their service tickets for time lost due to the stopping of the machine from any cause whatsoever, except in cases requiring special consideration.

An actual time study is then made on a run of work usually covering a period of two or three hours, indicating the time consumed on each unit, (*a*) or (*b*) or (*c*), etc. From this point the determination of the standard becomes to a certain extent a matter of personal equation. As a general proposition, however, the aim was to allow every man who conscientiously made an effort an opportunity to earn greater wages. In fact, the very essence of a successful bonus or piecework system is a well-distributed reward sufficient to secure from the men their maximum effort.

In a number of cases the men were found to be unable, after really trying, to reach the standard set, and in practically every one of these instances the schedule on the standard was so altered that a man could attain 90 and in some cases 95 per cent of the standard.

The efficiency expert summarized the results of his work as follows:

TABLE 27.—RESULTS OF EFFICIENCY PRACTICE DURING FIVE MONTHS, SHOWN FOR ENTIRE DEPARTMENT BY PERCENTAGE RATING AND EXTRA WAGES PER MAN PER WEEK.

Months.	Efficiency of department.	Extra wages paid per man per week.
	Per cent.	*Dollars.*
First month	64.7	0.00
Second month	76.5	.19
Third month	77.2	.48
Fourth month	85.3	.94
Fifth month	90.1	1.40
Sixth month	96.9	1.95
Seventh month	104.6	2.60
Eighth month	111.3	3.29
Ninth month	115.2	3.36

	Per cent.
Results to company:	
Increase in production	49.75
Decrease in cost	25
To workmen:	
Increased wages to men	26.8
Highest increased wages to workmen	70

Remarks: Workmen are satisfied and contented; only one man has quit because of dissatisfaction. No rates have been cut. Conditions were intensely complicated to begin with. Professional service discontinued after five months, and work turned over to client.

CHAPTER VI.

SELLING METHODS, PRICES, AND CONDITIONS.

Boston is the center of the cotton spinning machinery trade. All the plants manufacturing this line are easily accessible to Boston or have offices there. Every importing firm in the trade has representatives in Boston. In a measure this is due to the fact that the cotton manufacturing industry in this country was started in New England and is now one of the most important industries of that section.

Contrary to the custom of the cotton mills, which generally dispose of their goods through agents, the cotton textile machinery manufacturers do their own selling, and they have been very progressive in their selling methods. They keep in touch with all orders and the prospects at all times. No chance to sell escapes their constant vigilance. They keep in touch with the officers of all the more important cotton mills and sell many of the larger orders in person.

Salesmen are kept continually on the road, and are on a salary basis. Ordinarily no commissions are paid to the permanent sales force. These men make regular visits to the mills whether orders are expected or not, thus keeping the machinery plants posted on not only possible orders but all changes and improvements contemplated by the mills.

All machines when completed are first assembled and erected, then tested, at the shop, after which they are taken down, shipped, and again erected at the cotton mill. Machines sold to New England spinners are erected and put in running order at the mills free of charge. Outside of New England, machines are sold f. o. b. machine shop, and the cotton mill pays all freight and mill-erection charges. As all orders are on a competitive basis, it makes little or no difference whether machinery is sold f. o. b. shop or erection and freight charges paid. Necessarily all such differences are considered in quoting prices.

Southern offices are maintained by all the large firms for convenience in selling to the southern cotton mills. Supplies of card clothing and other common repair parts are kept at these offices. Repair and erecting men are stationed here so that they may be quickly available for rush orders.

RELATIONS OF SHOPS AND COTTON MILLS.

An official of one of the machinery plants may be quoted, in part, as follows:

> Owing to the fact that the competition between the various United States shops for the business which the mills have had to offer has been keen, it has been necessary for each shop to keep in close touch with the customers and users of its machinery.
>
> The shops maintain staffs of traveling men, generally expert in one department or another of the manufacture of cotton, whose business it is, when visiting mills, to take notice of the condition of the mill and the manner of the operation of its machinery, give advice, and make suggestions as to betterments in operation, where desired

or necessary. The experience gained by such experts has greatly aided mills generally to maintain their standards of quality and economy.

Such factors in the intimacy between the shops and the mills as above mentioned have brought about a close association, much more so, unquestionably, than would have been the case had the mills been dependent on foreign countries for the sources of their machinery supplies, and undoubtedly this close relationship, and the sympathetic ties between various groups of mills and the different shops, have materially assisted the splendid development of textile manufacturing, both in the Northern and Southern States, and have also firmly established its position.

The machinery manufacturers have frequently helped to finance the organization and the expansion of the cotton mills, by extending large and long-time credits, and have at times accepted mill stocks and bonds as part payments and in some instances payment in full for the machinery. (See p. 84.) Such stocks and bonds must often be carried by the machinery manufacturers for many years. If the mill is profitable they may perhaps be sold at a profit, but if not they must be retained or sold at a loss. As a general thing, such securities are accepted at less than their face value or else the sales price of the machinery is advanced by a corresponding amount.

Of the three firms studied, one still retains practically all the securities accepted, one has retained a major part and has distributed most of the remainder as dividends to its stockholders. The third firm has sold virtually all securities accepted during recent years, such stocks and bonds having been sold to or through a securities company organized by themselves for this purpose. The security company and the machinery manufacturing company with which it does business are firmly connected by interlocking directorates.

The majority of cotton-mill securities accepted by the machinery firms seldom get very far from their control. An official of one firm stated that though in some cases the acceptance of securities had been unprofitable, on the whole he considered that this practice had been very advantageous to his firm. It had enabled them to put their machinery in many mills at the time of their organization, and later these mills when increasing their equipment had in nearly all cases purchased again from them.

A member of one large American firm, in discussing this subject, said:

> It has been stated that the American textile machinery shops were presumably in a trust, and by large stock ownership in the various mills had a monopoly of the business.
>
> These statements are absolutely erroneous, as the shops have had the fiercest competition, and the ownership of stock has partly been brought about by helping struggling mills to develop, and more largely by compulsion in reorganization necessitated by too little mill capital, such as occurred in the cases of a number of mills, where the machine shops had the choice of losing all the amounts owing to them for machinery or accepting stock in payment. In this way it is true that the shops have directly and indirectly been the means of furnishing a large amount of capital to cotton mills, which has benefited the South especially, and the shops should be praised and not condemned for this. Although the ownership of the stocks taken to help the mills start has given the shops some business in dull times, the investment has proved expensive, as it has been impossible to convert some of these stocks into cash in any large amount except at heavy discount, and there has been no market at all for many such stocks.

One bad side to this custom of accepting securities in payment of machinery for new mill construction is that it artificially stimulates the building of cotton mills. This has a tendency to make the demand for machinery very brisk for a few years, and then to bring on a period of very dull times, lasting until the consumption of cotton goods can catch up with cotton-mill capacity. A chart showing the

sales of one large plant from 1840 to 1912 shows very clearly the ups and downs of the volume of sales over that period. Sales start at a low point and gradually rise, reaching the high point at about the end of each seven-year period; then they fall sharply and again rise gradually to a high point about seven years later.

This rise and fall has been consistent over the entire period from 1840 to date. The period 1909 to 1910 was one of the high points, with a sharp fall in 1912 to 1913. The year 1914 was better, and the prediction is that 1915 will make a great advance over 1914, with every likelihood that the advance will continue into 1916.

SELLING PRICES.

Although the machinery manufacturers had a sales price agreement at one time, the records indicate that it was not adhered to. High prices have existed only during the times when the demand for machinery was great and when the demand alone would have kept them very firm. The instant the demand was reduced the most severe competition set in. For example, the average price of a 40-inch revolving top flat card in 1909, when the demand was very great, was $587.70. In 1914, when business was not good, it was $439.24.

There are two factors that produce this severe competition. One is that cotton-spinning machinery plants are equipped with special machines to manufacture only such machinery and it is not possible for them to manufacture other kinds economically; the other is the small size of the industry, three large firms producing between 80 and 90 per cent of the total output of the country.

During dull times it is absolutely necessary for these organizations to keep all of their technical men, foremen, second hands, most of the principal machinists, erectors, and even many machine hands and less skilled workers. These, if allowed to go, would become skilled in some other industries, and when times became better it would be impossible to get them back. The training of new workers would then be necessary, as the only men skilled in this industry are now being employed therein. Such conditions make competition very keen during dull periods.

The decline in selling prices in recent years was commented upon by one of the manufacturers already quoted, as follows:

> It is doubtful whether cotton-mill men, as a whole, are desirous of having machinery prices at the lowest possible level, for the reason that while this would be of advantage to new enterprises, it means depreciation in the value of the investment in the case of an established mill where the machinery has for some time been installed. We do not mean that every purchaser of machinery does not try to obtain the lowest possible price at the time he buys, but that, as a general proposition, there has been no cry or demand from the cotton-mill trade for a low level, or a level of prices unprofitable to the machine builder. As a matter of fact, however, present-day prices, and those which have been maintained now for the past two years are absurdly low—so low that in almost every case where competitive machinery is sold it nets a positive loss to the shop, the reason being that (due to depressed conditions in the textile-mill industry) there has been a minimum of new mill construction, as well as of reequipment of existing mills. The result of this has been a ruinous condition of competition among the machine shops, due to the endeavors of each to keep its plant in operation and thus retain its organization.
>
> The low prices prevailing for American machines have prevented the importation of practically any English or other foreign machinery, and until the buying by mills increases to a point which will enable the builders to advance their prices it can not be stated whether the present tariff will admit of machinery being manufactured at a profit to the United States maker. The fact that English machinery of quality which

compares most favorably with the best of the United States builders can be imported in unlimited quantities, dependent only on the price, limits the maximum figures to which the domestic builder can increase his prices, and whether or not the maximum to which he can advance them and still retain the market as against foreign competition will net him a fair profit is something that it remains for the future to prove.

It is quite possible that a perfectly accurate knowledge of unit costs on the part of all the machinery builders will have a tendency toward a more rational maintenance of proper prices on all machines. Under the present system it often occurs that the cost of a given machine has no particular relation to the selling price, the latter, especially during slack seasons, being determined mostly by prices made, or said to be made, by competitors. The result of this situation is that during slack seasons, when costs are necessarily higher than usual, selling prices have a tendency to go lower.

The following tables, showing the decline in prices of cotton spinning machinery in recent years, were compiled from the records of American manufacturers and of importers of English machinery:

TABLE 28.—HIGHEST AND LOWEST SELLING PRICES OF STANDARD AMERICAN-MADE 40-INCH REVOLVING TOP FLAT CARDS, DRAWING FRAMES, ROVING FRAMES, AND RING SPINNING FRAMES, 1897 TO 1914.

Years.	40-inch card, per card.		Drawing frame, per delivery.		Roving frame, per spindle.		Ring spinning frame, per spindle.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1897	$675.00	$589.00	$75.00	$68.51	$6.60	$6.50	$3.25	$3.12
1898	675.00	598.00	73.22	67.54	7.85	6.57	3.14	2.98
1899	675.00	584.00	75.00	70.47	7.68	6.50	3.25	3.16
1900	675.00	633.00	75.00	71.50	7.88	6.50	3.39	3.25
1901	680.00	644.00	75.00	73.43	7.98	6.50	3.40	3.25
1902	675.00	566.00	75.00	58.20	7.19	6.50	3.25	3.05
1903	675.00	577.00	75.00	63.16	6.97	6.50	3.25	3.00
1904	675.00	428.00	75.00	50.11	6.50	5.16	3.21	1.93
1905	675.00	456.00	75.00	43.14	6.88	5.89	3.12	2.32
1906	675.00	537.00	75.00	56.15	7.10	6.50	3.26	2.86
1907	744.00	572.00	77.00	66.00	7.57	6.06	3.53	2.84
1908	725.00	528.00	75.00	51.42	7.36	6.47	4.02	2.74
1909	700.00	500.00	75.00	53.25	7.46	6.29	3.25	2.23
1910	689.00	400.00	79.00	45.00	7.28	5.35	3.40	2.20
1911	650.00	400.00	75.00	40.00	7.26	5.79	3.45	1.87
1912	610.00	375.00	75.00	40.00	5.50	4.85	3.10	1.30
1913	500.00	400.00	73.65	45.00	5.50	4.20	3.10	1.30
1914	500.00	400.00	65.00	42.50	4.90	4.61	2.70	1.39

TABLE 29.—COMPARATIVE SELLING PRICES F. O. B. BOSTON OF 40-INCH REVOLVING TOP FLAT CARDS, 27-INCH DOFFER, CLOTHED, OF AMERICAN AND ENGLISH MANUFACTURE, 1908 TO 1914.

Years.	Three principal American manufacturers.				Six principal English manufacturers.			
	Cards manufactured.	Selling prices f. o. b. Boston.			Cards imported.	Selling prices f. o. b. Boston.		
		Highest.	Lowest.	Average.		Highest.	Lowest.	Average.
1908	2,622	$725.00	$528.00	$616.77	(a)	$797.50	$570.00	$641.25
1909	3,642	700.00	500.00	587.70	301	792.50	550.00	637.00
1910	3,579	689.00	400.00	578.91	279	677.50	500.00	516.00
1911	2,415	650.00	400.00	547.87	105	675.00	500.00	650.00
1912	2,610	610.00	375.00	478.09	49	725.00	542.00	600.00
1913	2,405	500.00	409.00	477.36	13	b 650.00	475.00	600.00
1914	1,963	500.00	400.00	439.24	12	680.00	475.00	582.00
Total	19,236	.....	.....	.....	759	.....	.....	.....

a Not reported. b No sales of highest-priced cards.

TABLE 30.—COMPARATIVE SELLING PRICES, PER DELIVERY F. O. B. BOSTON, OF ENGLISH AND AMERICAN DRAWING FRAMES, 1908 TO 1915.

Years.	English.			American.					
	Standard rolls, not metallic.			Metallic rolls.			Leather-covered rolls.		
	Highest.	Lowest.	Average.	Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
1908	$76.00	$65.00	$69.00	$75.00	$60.00	$66.00	$67.91	$51.42	$64.00
1909	65.50	60.00	61.54	75.00	58.33	65.00	60.00	53.25	59.00
1910	64.00	60.50	62.25	79.00	45.00	64.00	60.00	49.00	52.00
1911	61.00	55.75	58.50	75.00	40.00	62.00	60.00	50.00	57.77
1912	68.00	57.25	62.00	75.00	42.00	53.00	50.00	40.00	44.00
1913	68.50	68.50	68.50	73.65	45.00	57.00	50.00	46.94	48.16
1914	60.00	58.00	59.00	65.00	42.50	55.00	60.00	50.00	57.50
1915	58.25	54.00	56.00	.....	.....	.....	.....	.....	.....

TABLE 31.—COMPARATIVE SELLING PRICES, PER SPINDLE, F. O. B. BOSTON, OF RING SPINNING FRAMES HAVING 240 SPINDLES EACH, 3½-INCH GAUGE, 1908 TO 1915.

Years.	English.			American.		
	Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
1908	$4.62½	$4.62½	$4.62½	$4.02	$2.97	$3.52
1909	4.53	3.97	4.25	3.70	2.68	3.07
1910	4.19	3.55	4.04½	3.40	2.65	3.14
1911	3.95	3.85	3.90	3.45	2.40	2.63
1912	4.20	3.54	3.83	3.10	1.75	2.33
1913	4.49	4.27	4.38	3.10	1.75	2.26
1914	3.80	3.62	3.71	2.70	1.84	2.16
1915	4.07	3.58	3.63½	.....	.....	.....

TABLE 32.—COMPARATIVE SELLING PRICES PER SPINDLE, F. O. B. BOSTON, OF RING SPINNING FRAMES HAVING 208 SPINDLES EACH, 2¾-INCH GAUGE, 1908 TO 1915.

Years.	English.			American.		
	Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
1908	$4.12½	$4.12½	$4.12½	$3.15	$2.74	$2.95
1909	3.93	3.54	3.80	3.25	2.23	2.62
1910	3.74	3.54	3.61	2.95	2.20	2.67
1911	3.52	3.42½	3.47	3.00	1.87	2.14
1912	3.73	3.15	3.90	2.65	1.30	1.75
1913	4.00	3.80	3.30	2.65	1.30	1.81
1914	3.38	3.22	3.16	2.25	1.39	1.61
1915	3.54	3.05	.....	.....	.....	.....

CHAPTER VII.

WORKING CONDITIONS.

The general working conditions were found to be good in all the establishments visited. The men appeared to be well treated and seemed to be contented and to like their work. In some plants there were men who have been employed there continuously for 50 years or more.

The fact that no strikes of any importance have occurred in this industry is convincing proof of the ability of the administrative officers to understand and direct labor. Of the plants visited none has the reputation of being a "drive shop." Many things are done for the welfare of the workmen. The plants are clean, light, and in every way sanitary, adding much to the efficiency of the shop as well as to the convenience and the health of the workmen. The machinery is well protected, and the danger of accident reduced to a minimum. Where dust, filings, and other dangerous substances are found, blowing systems have been installed to carry them away. In the brass foundries, where dangerous gases are formed, it is customary to change the men every two weeks, those relieved returning to the iron foundry, from which they had come. While at work in the brass foundry their pay is increased, and on account of the increased pay, a molder is considered fortunate to get such work, the exposure to the gases not being long enough to endanger his health. In some places good houses are furnished for the married workmen at a rental much below the average local rates. In two cases hotels have been built for the accommodation of workmen with no families.

OCCUPATIONS.

The employees in this industry are mostly men. So few women are employed that they have not been included in the following tables. Most of the operatives in the shops are machine hands. Very few journeymen mechanics are employed, and these are largely engaged in tool and plant repairs. The introduction of many automatic and semiautomatic machines, and of machine molds in the foundries, has permitted the use of unskilled and semiskilled men and has reduced the number of journeymen machinists and skilled hand molders to a minimum. In both shop and foundry some employes work at time and others at piece rates, though the time workers greatly predominate.

Below is given a list of the principal occupations and a short description of the work performed in each:

Annealers and helpers, who temper the metal and do much of the heavy lifting, etc.
Bench and machine hands, generally employed on special work, such as making fliers. Some of this work is done by hand and some with semiautomatic tools.
Blacksmiths and helpers, to do ordinary blacksmith work in the plant.

Brush and comb makers, who manufacture brushes and combs used as parts of the machine produced.
Card clothiers and grinders, who attach the card clothing to the cylinders and top flats of the card, also grind the wire points of this clothing so that the completed machine will be properly adjusted.
Casting cleaners, who receive the rough castings from the foundry and scrape off sand and rough particles of metal before the castings are sent to the polishing room.
Core makers. Foundry workers who make cores for molding purposes.
Cupola hands. Workmen at the cupola.
Draftsmen, generally employed in the manufacturing office to design and correct plans for new and old machines.
Electricians and helpers, employed principally upon plant repairs.
Engineers, employed in the power house of the plant.
Erectors and helpers, who assemble the machines manufactured and see that each machine is in perfect running order before it is taken apart and packed for shipment.
Erectors and helpers, outside, who are sent to the cotton mill to unpack and erect the machinery upon the floor of the mill and see that it is working satisfactorily before they leave.
Janitor and watchman, at office and plant.
Laborers, who may be employed at heavy work in either yard, shop, or foundry.
Machine hands; in most cases semiskilled men employed to run the different producing machines in the shop, namely, lathes and similar machines, planing and milling machines, top flat machines.
Machine hands, automatic, the same as machine hands, except that they run automatic or semiautomatic machines.
Machinists and helpers, journeymen machinists employed mostly in tool room and plant repair work.
Masons, both stone and brick masons employed in plant repair work.
Molders, hand, foundry molders using hand instead of machine methods.
Molders and helpers, machine, who operate molding machines and do no hand molding.
Painters. Most of the painting in this industry is done by the dipping process. The men doing this work are called painters, though they are in reality dippers, with the exception of a few painters employed in plant repair work.
Pattern makers and helpers, who are engaged in making wood and metal patterns for the foundry.
Plumbers, employed in plant repair work.
Polishers and grinders, who receive the castings from the casting cleaners and polish and grind the surfaces to be machined.
Roll coverers, who cover metal rolls with a leather surface.
Storekeepers, in charge of the storerooms.
Tinsmiths, who make certain parts of the machines where tin and sheet iron are used.
Woodworkers and carpenters, who do the necessary woodwork on the machines made. The carpenters are employed principally on plant repair work.

EARNINGS.

Tables 33 to 38 show for the more important occupations in each establishment reported upon, and for all combined, the net earnings, length of average working day and of full-time week, and the average earnings per week. The average working hours per day and in a full-time week were based on representative weekly pay rolls and not on the average for the year for the plant.

TABLE 33.—AVERAGE FULL-TIME WEEKLY EARNINGS AND AVERAGE AND CLASSIFIED RATES OF WAGES PER HOUR OF MALE WORKERS IN COTTON-SPINNING MACHINERY MANUFACTURING PLANTS, BY YEARS, 1906, 1908, 1910, AND 1914.

Occupation and number of plants.	Year.	Piece or time workers.	Number of employees.	Average full-time hours per week.	Average rate of wages per hour.	Average full-time weekly earnings.	Number of employees earning each classified rate of wages per hour.[a]										
							Under 10 cents.	10 and under 12 cents.	12 and under 14 cents.	14 and under 16 cents.	16 and under 18 cents.	18 and under 20 cents.	20 and under 25 cents.	25 and under 30 cents.	30 and under 35 cents.	35 and under 40 cents.	40 cents and over.
Annealers and helpers:																	
2 plants	1906	Time	11	55.30	$0.142	$7.84			7	3			1				
2 plants	1908	do	8	55.00	.153	8.42			4	1	2		1				
2 plants	1910	do	9	53.90	.142	7.64		3	2	1	2		1				
1 plant	1914	do	3	50.00	.140	7.00			1	2							
Bench and machine hands:																	
2 plants	1906	do	28	58.00	.168	9.73		2	3	6	7	6	2	2			
1 plant	1908	do	9	51.67	.210	10.86					1	1	6	1			
2 plants	1910	do	36	55.60	.186	10.35		4	1	2	5	8	12	4			
1 plant	1914	Piece	14	57.00	.234	13.36											
1 plant	1914	Time	23	57.00	.232	13.21					1	2	13	3	4		
Blacksmiths and helpers:																	
1 plant	1906	Piece	2	58.00	.247	14.33											
4 plants	1906	Time	89	58.00	.178	10.32	1	9	5	19	17	10	19	8	1		
2 plants	1908	Piece	25	53.33	.235	12.54											
5 plants	1908	Time	74	49.90	.198	9.90			2	13	15	8	24	11		1	
4 plants	1910	Piece	35	55.20	.275	15.20											
5 plants	1910	Time	93	54.80	.190	10.38		1	4	18	25	10	23	9	3		
3 plants	1914	Piece	21	52.80	.194	10.25											
5 plants	1914	Time	74	53.70	.218	11.71		1			18	10	26	13	4	1	1
Brush and comb makers:																	
1 plant	1906	Piece	1	58.00	.315	18.29											
1 plant	1906	Time	31	58.00	.145	8.42	2	4	8	8	4	3	2				
1 plant	1908	Piece	1	51.67	.309	15.98											
1 plant	1910	Time	3	57.00	.193	11.02			1				1	1			
1 plant	1914	Piece	5	57.00	.173	9.87											
1 plant	1914	Time	18	57.00	.198	11.30				1	7	1	8	1			
Card clothiers and grinders:																	
1 plant	1906	do	21	58.00	.163	9.46			2	11	4	2	1	1			
1 plant	1908	Piece	1	51.67	.197	10.20											
1 plant	1908	Time	18	51.67	.209	10.83				1	1	6	7	1	2		
1 plant	1910	do	22	57.00	.188	10.73				3	4	6	9				
1 plant	1914	Piece	1	57.00	.155	8.84											
1 plant	1914	Time	9	57.00	.214	12.22					1	1	7				

Casting cleaners:																
1 plant	1906	Piece	4	58.00	.192	11.16										
3 plants	1906	Time	123	58.00	.143	8.27		1	66	45	5	1	2	1		2	
2 plants	1908	Piece	6	51.67	.199	10.27											
4 plants	1908	Time	156	48.30	.151	7.29			13	109	29	2	2	1			
1 plant	1910	Piece	19	58.00	.186	10.76											
5 plants	1910	Time	380	55.70	.148	8.27		6	73	253	38	5	4	1			
2 plants	1914	Piece	10	55.00	.217	11.91											
3 plants	1914	Time	140	52.60	.161	8.45				18	116	4	1	1			
Core makers:																	
2 plants	1906	Piece	6	58.00	.217	12.57											
3 plants	1906	Time	24	58.00	.140	8.11	5	3	4	8	1		2			1	
1 plant	1908	Piece	5	55.00	.238	13.11											
4 plants	1908	Time	35	52.00	.162	8.44		5	10	8	3	1	5	1	1	1	
4 plants	1910	Piece	25	53.40	.186	9.92											
4 plants	1910	Time	40	56.30	.155	8.73	3	10	2	12	5		4	2	1	1	
3 plants	1914	Piece	19	53.00	.186	9.84											
4 plants	1914	Time	27	55.00	.170	9.37		3	4	8	3	3	4	1	1		
Cupola hands:																	
2 plants	1906	...do	14	58.00	.181	10.47				6	3	1	3	1			
3 plants	1908	...do	33	54.00	.179	9.64				17	5	3	5	2	1		
2 plants	1910	...do	19	52.60	.192	10.09				8		2	6	3			
2 plants	1914	...do	21	56.40	.202	11.40					10		7	4			
Draftsmen:																	
3 plants	1906	...do	19	56.70	.355	20.13							4	3	4	2	6
3 plants	1908	...do	19	52.90	.357	18.90				1	2	1		1	5	3	6
3 plants	1910	...do	17	52.90	.338	17.86				1			3	1	4	4	4
4 plants	1914	...do	31	50.80	.453	23.02				1		1	1	1	2	4	21
Electricians and helpers:																	
1 plant	1906	...do	1	58.00	.259	15.00								1			
1 plant	1908	...do	2	55.00	.239	13.15					1				1		
1 plant	1910	...do	4	58.00	.216	12.53			1	1		1					1
4 plants	1914	...do	16	54.30	.226	12.26				3	1	2	6		4		
Engineers:																	
1 plant	1914	...do	1	55.00	.180	9.90								1			
Erectors and helpers:																	
2 plants	1906	Piece	11	58.00	.185	10.73											
5 plants	1906	Time	529	57.80	.174	10.05	9	20	54	114	86	77	150	17	1	1	
1 plant	1908	Piece	10	55.00	.254	13.98											
5 plants	1908	Time	428	50.80	.203	10.31	1	2	10	33	84	63	177	47	9	2	
2 plants	1910	Piece	18	47.20	.236	11.12											
5 plants	1910	Time	818	54.20	.189	10.25	5	5	29	129	176	134	272	60	6	2	
1 plant	1914	Piece	8	55.00	.284	15.64											
5 plants	1914	Time	360	52.80	.227	12.00		3	2	10	29	38	162	83	24	8	1
Erectors and helpers—outside:																	
3 plants	1906	...do	68	56.60	.214	12.10		1	5	5	7	3	27	15	3	2	
4 plants	1908	...do	108	50.50	.231	11.66			1	10	13	7	26	42	7	1	1
4 plants	1910	...do	131	53.20	.235	12.50			3	12	12	9	37	38	15	2	3
2 plants	1914	...do	46	51.70	.284	14.67					1		4	26	11	3	1

[a] This information could not be given for pieceworkers.

TABLE 33.—AVERAGE FULL-TIME WEEKLY EARNINGS AND AVERAGE AND CLASSIFIED RATES OF WAGES PER HOUR OF MALE WORKERS IN COTTON-SPINNING MACHINERY MANUFACTURING PLANTS, BY YEARS, 1906, 1908, 1910, AND 1914—Continued.

Occupation and number of plants.	Year.	Piece or time workers.	Number of employees.	Average full-time hours per week.	Average rate of wages per hour.	Average full-time weekly earnings.	Number of employees earning each classified rate of wages per hour.										
							Under 10 cents.	10 and under 12 cents.	12 and under 14 cents.	14 and under 16 cents.	16 and under 18 cents.	18 and under 20 cents.	20 and under 25 cents.	25 and under 30 cents.	30 and under 35 cents.	35 and under 40 cents.	40 cents and over.
Janitors and watchmen:																	
1 plant	1906	Time	4	58.00	$0.140	$8.10	.....	.....	2	2	.....	.....	.....	.....	.....	.....	.....
1 plant	1908	...do	5	55.00	.153	8.39	.....	.....	.....	3	2	.....	.....	.....	.....	.....	.....
1 plant	1910	...do	5	45.00	.152	6.86	.....	.....	.....	3	2	.....	.....	.....	.....	.....	.....
1 plant	1914	...do	4	55.00	.158	8.68	.....	.....	.....	2	2	.....	.....	.....	.....	.....	.....
Laborers:																	
1 plant	1906	Piece	15	58.00	.248	14.37	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4 plants	1906	Time	370	57.00	.139	7.94	1	7	225	102	23	1	9	1	1	.....	.....
1 plant	1908	Piece	8	55.00	.240	13.18	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4 plants	1908	Time	412	52.80	.162	8.57	.....	2	40	54	257	27	13	17	2	.....	.....
1 plant	1910	Piece	22	45.00	.248	11.17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4 plants	1910	Time	300	54.60	.154	8.41	1	1	48	170	58	6	11	4	1	.....	.....
2 plants	1914	Piece	26	54.80	.254	13.94	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4 plants	1914	Time	340	54.70	.167	9.14	.....	.....	11	158	105	17	32	11	5	1	.....
Machine hands:																	
5 plants	1906	Piece	244	56.90	.207	11.76	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5 plants	1906	Time	827	57.40	.156	8.95	28	34	147	290	127	79	105	15	2	.....	.....
5 plants	1908	Piece	210	52.30	.252	13.15	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5 plants	1908	Time	796	49.60	.179	8.90	12	11	27	143	190	161	221	25	4	2	.....
4 plants	1910	Piece	192	53.20	.232	12.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5 plants	1910	Time	1,058	56.60	.176	9.94	39	13	72	235	214	124	319	31	9	2	.....
4 plants	1914	Piece	258	53.70	.278	14.93	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5 plants	1914	Time	572	53.90	.198	10.68	2	9	9	46	127	83	232	47	14	3	.....
Machine hands, automatic:																	
3 plants	1906	Piece	61	57.20	.191	10.93	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4 plants	1906	Time	123	57.50	.154	8.87	4	13	22	38	22	8	10	4	1	1	.....
3 plants	1908	Piece	112	53.60	.217	11.65	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4 plants	1908	Time	147	51.30	.192	9.83	.....	3	4	22	33	22	46	12	5	.....	.....
3 plants	1910	Piece	104	54.00	.192	10.38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5 plants	1910	Time	224	55.40	.180	9.98	.....	9	14	41	47	45	47	16	4	1	.....
4 plants	1914	Piece	31	53.50	.213	11.41	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5 plants	1914	Time	211	52.50	.201	10.54	.....	3	3	25	33	33	78	28	8	.....	.....
Machine hands, lathe:																	
2 plants	1906	Piece	25	58.00	.191	11.08	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3 plants	1906	Time	332	58.00	.157	9.09	5	33	41	102	73	34	36	7	.....	1	.....
2 plants	1908	Piece	47	53.80	.212	11.42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3 plants	1908	Time	274	46.40	.173	8.02	3	6	14	50	95	50	46	9	1	.....	.....

3 plants	1910	Piece	52	49.30	.242	11.91									
3 plants	1910	Time	539	55.30	.174	9.64	1	2	25	98	183	127	85	16	1	1	
3 plants	1914	Piece	39	54.20	.229	12.38											
3 plants	1914	Time	159	52.20	.206	10.73				5	25	37	76	12	3	1	
Machine hands, planing and milling:																	
3 plants	1906	Piece	76	57.20	.188	10.77											
4 plants	1906	Time	308	57.90	.165	9.56	6	12	50	73	58	47	51	10	1		
2 plants	1908	Piece	70	55.00	.206	11.31											
4 plants	1908	Time	204	52.30	.182	9.53	1	1	19	26	50	40	57	6	2	2	
3 plants	1910	Piece	91	47.30	.223	10.55											
4 plants	1910	Time	369	53.60	.186	9.97		5	14	46	82	80	123	17	2		
2 plants	1914	Piece	72	53.90	.227	12.26											
4 plants	1914	Time	272	52.80	.201	10.62			5	13	59	43	122	24	5	1	
Machine hands, top flat:																	
2 plants	1906	Piece	10	58.00	.234	13.57											
2 plants	1906	Time	20	58.00	.151	8.73	2	1	2	7	3	3	1	1			
1 plant	1908	Piece	14	55.00	.200	11.01											
2 plants	1908	Time	11	47.70	.204	9.71				3	1	1	4	1	1		
2 plants	1910	Piece	23	50.70	.216	10.95											
2 plants	1910	Time	13	55.00	.192	10.57				5	1	1	4	2			
2 plants	1914	Piece	12	52.50	.246	12.90											
2 plants	1914	Time	10	52.00	.202	10.50			1		4		4			1	
Machinists and helpers:																	
4 plants	1906	...do	112	58.00	.209	12.10		5	6	13	7	5	46	27	3		
4 plants	1908	...do	129	49.60	.230	11.43	2	1	1	7	9	10	46	43	9	1	
1 plant	1910	Piece	1	45.00	.117	5.24											
5 plants	1910	Time	219	54.40	.221	12.02	2	3	7	24	17	13	76	55	19	3	
2 plants	1914	Piece	5	51.00	.187	9.53											
5 plants	1914	Time	135	51.80	.244	12.66	1	1	1	6	10	7	45	32	25	5	2
Masons:																	
1 plant	1906	...do	1	58.00	.200	11.60							1				
2 plants	1914	...do	3	51.70	.257	13.27					1			1		1	
Molders, hand:																	
1 plant	1908	...do	63	55.00	.252	13.85		1	3	1	1			53	4		
Molders and helpers, machine:																	
4 plants	1906	Piece	246	57.60	.258	14.86											
2 plants	1906	Time	111	58.00	.157	9.12		1		86	3	1	17	2	1		
4 plants	1908	Piece	249	51.60	.244	12.59											
4 plants	1908	Time	79	50.20	.182	9.15			13	17	21	3	17	3	3	2	
4 plants	1910	Piece	266	55.70	.280	15.61											
4 plants	1910	Time	57	54.80	.193	10.55			1	27	13	1	4	4	4	3	
4 plants	1914	Piece	321	51.10	.200	10.23											
4 plants	1914	Time	93	52.40	.222	11.62			21	3	13	3	5	41	5	1	1
Painters:																	
1 plant	1906	Piece	1	58.00	.223	12.96											
5 plants	1906	Time	97	57.50	.153	8.80	4	1	17	31	25	13	6				
5 plants	1908	...do	78	49.50	.178	8.82		4	2	12	17	15	26	2			
5 plants	1910	...do	139	55.30	.164	9.09	1	11	12	29	35	24	27				
2 plants	1914	Piece	3	50.00	.178	8.89											
5 plants	1914	Time	102	52.50	.185	9.73		4	2	7	19	28	36	6			

TABLE 33.—AVERAGE FULL-TIME WEEKLY EARNINGS AND AVERAGE AND CLASSIFIED RATES OF WAGES PER HOUR OF MALE WORKERS IN COTTON-SPINNING MACHINERY MANUFACTURING PLANTS, BY YEARS, 1906, 1908, 1910, AND 1914—Continued

Occupation and number of plants.	Year.	Piece or time workers.	Number of employees.	Average full-time hours per week.	Average rate of wages per hour.	Average full-time weekly earnings.	Number of employees earning each classified rate of wages per hour.										
							Under 10 cents.	10 and under 12 cents.	12 and under 14 cents.	14 and under 16 cents.	16 and under 18 cents.	18 and under 20 cents.	20 and under 25 cents.	25 and under 30 cents.	30 and under 35 cents.	35 and under 40 cents.	40 cents and over.
Pattern makers and helpers:																	
5 plants	1906	Time	30	57.40	$0.235	$13.47	.....	1	2	1	.....	3	9	8	5	.....	1
5 plants	1908	...do	45	51.00	.260	13.27	2	.....	.....	2	1	2	6	17	8	7	.....
5 plants	1910	...do	40	53.60	.272	14.55	1	1	1	3	2	1	2	11	11	4	3
5 plants	1914	...do	75	54.70	.261	14.25	1	2	1	1	8	4	11	26	6	8	7
Plumbers:																	
1 plant	1906	...do	1	58.00	.250	14.50	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....
1 plant	1908	...do	1	55.00	.265	14.58	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....
1 plant	1910	...do	1	45.00	.265	11.93	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....
1 plant	1914	...do	1	55.00	.265	14.58	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....
Polishers and grinders:																	
1 plant	1906	Piece	4	58.00	.258	14.98	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5 plants	1906	Time	103	57.60	.177	10.21	1	1	3	35	23	12	22	6	.....	.....	.....
2 plants	1908	Piece	9	53.10	.246	13.04	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5 plants	1908	Time	115	49.80	.192	9.58	.....	.....	3	15	30	19	32	15	1	.....	.....
5 plants	1910	...do	160	56.00	.192	10.77	.....	1	1	12	45	43	44	13	1	.....	.....
2 plants	1914	Piece	7	55.20	.255	14.05	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5 plants	1914	Time	80	53.80	.209	11.22	.....	.....	.....	.....	10	28	25	15	2	.....	.....
Power-plant employees:																	
1 plant	1906	Piece	1	58.00	.143	8.29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3 plants	1906	Time	28	56.50	.191	10.80	.....	.....	4	7	3	3	6	.....	5	.....	.....
5 plants	1908	...do	85	48.30	.194	9.38	.....	1	17	12	11	7	15	13	8	1	.....
4 plants	1910	...do	68	54.80	.204	11.19	.....	1	12	8	8	2	15	13	8	.....	1
4 plants	1914	...do	23	50.40	.210	10.60	.....	.....	.....	2	9	3	5	3	1	.....	.....
Roll coverers:																	
1 plant	1906	Piece	1	55.00	.180	9.90	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1 plant	1906	Time	2	55.00	.171	9.39	.....	.....	.....	.....	2	.....	.....	.....	.....	.....	.....
1 plant	1908	Piece	5	55.00	.200	10.98	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1 plant	1908	Time	4	55.00	.166	9.15	.....	.....	.....	1	2	1	.....	.....	.....	.....	.....
1 plant	1914	Piece	9	50.00	.191	9.54	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1 plant	1914	Time	4	50.00	.173	8.63	.....	.....	.....	1	1	1	1	.....	.....	.....	.....
Storekeepers:																	
2 plants	1906	...do	6	58.00	.119	6.91	4	.....	.....	.....	.....	.....	1	1	.....	.....	.....
1 plant	1908	...do	4	55.00	.124	6.81	3	.....	.....	.....	.....	.....	1	.....	.....	.....	.....
1 plant	1910	...do	4	45.00	.140	6.30	2	.....	.....	1	.....	.....	1	.....	.....	.....	.....
2 plants	1914	...do	6	56.30	.220	12.39	.....	.....	.....	1	1	1	.....	2	1	.....	.....

Tinsmiths:																	
3 plants	1906	Piece	33	56.70	.219	12.42											
5 plants	1906	Time	111	56.10	.170	9.55	2	2	10	33	17	16	29	2			
3 plants	1908	Piece	26	53.80	.221	11.86											
5 plants	1908	Time	155	51.50	.188	9.66	2	4	12	22	29	17	45	23	1		
3 plants	1910	Piece	26	52.80	.237	12.53											
5 plants	1910	Time	110	55.50	.181	10.06	3	6	2	28	27	7	19	16	2		
3 plants	1914	Piece	15	53.30	.241	12.83											
5 plants	1914	Time	94	52.40	.211	11.08		2		3	22	20	17	24	6		
Woodworkers and carpenters:																	
3 plants	1906	Piece	14	57.40	.227	13.02											
5 plants	1906	Time	186	57.50	.184	10.55	2	5	7	35	35	34	53	11	4		
3 plants	1908	Piece	12	53.90	.245	13.23											
5 plants	1908	Time	272	50.70	.206	10.44		13	4	5	59	53	92	35	6	3	2
3 plants	1910	Piece	15	47.10	.266	12.54											
5 plants	1910	Time	324	55.50	.213	11.81		4	3	17	62	36	124	58	12	5	3
2 plants	1914	Piece	9	53.90	.281	15.17											
5 plants	1914	Time	179	53.90	.231	12.46			1	6	16	18	79	39	11	6	3

TABLE 34.—NET EARNINGS, LENGTH OF AVERAGE WORKING DAY AND OF FULL-TIME WEEK, AND AVERAGE EARNINGS PER WEEK OF MACHINE HANDS IN COTTON-SPINNING MACHINERY PLANTS, 1906, 1908, 1910, AND 1914.

Years and establishments.	Earnings per hour.			Average working hours per day.	Average working hours in full-time week.	Average earnings in full-time week.
	Highest.	Lowest.	Average.			
1906.	*Cents.*	*Cents.*	*Cents.*	*H. m.*	*H. m.*	
No. 1	27.5	8	16.46	9 40	58 00	$9.55
No. 2	25	10	15.24	9 10	55 00	8.38
No. 3	26	9	15.94	9 40	58 00	9.25
No. 5	25	9	14.68	9 40	58 00	8.51
No. 6	30	5	15.25	9 40	58 00	8.85
All establishments	30	5	15.60	9 34	57 24	8.95
1908.						
No. 1	35	11	17.89	7 30	45 00	8.05
No. 2	26	12	16.91	9 10	55 00	9.30
No. 3	26	11	18.36	7 30	45 00	8.26
No. 5	26.5	12	18.21	9 10	55 00	10.02
No. 6	30	7	18.03	8 37	51 40	9.32
All establishments	35	7	17.94	8 16	49 36	8.90
1910.						
No. 1	32.5	12	17.52	9 40	58 00	10.16
No. 2	30.5	10	16.92	9 10	55 00	9.31
No. 3	20	13	16.35	9 10	55 00	8.99
No. 5	26.5	8	17.00	7 30	45 00	7.65
No. 6	39	8	17.90	9 30	57 00	10.20
All establishments	39	8	17.57	9 26	56 36	9.94
1914.						
No. 1	35	15	19.60	8 20	50 00	9.80
No. 2	31.5	11	18.47	8 20	50 00	9.24
No. 3	37	16	21.75	8 20	50 00	10.88
No. 5	29	16	20.71	9 10	55 00	11.39
No. 6	39	8	20.31	9 30	57 00	11.58
All establishments	39	8	19.82	8 59	53 54	10.68

TABLE 35.—NET EARNINGS, LENGTH OF AVERAGE WORKING DAY AND OF FULL-TIME WEEK, AND AVERAGE EARNINGS PER WEEK OF MACHINE HANDS OPERATING AUTOMATIC MACHINES IN COTTON-SPINNING MACHINERY PLANTS, 1906, 1908, 1910, AND 1914.

Years and establishments.	Earnings per hour.			Average working hours per day.	Average working hours in full-time week.	Average earnings in full-time week.
	Highest.	Lowest.	Average.			
1906.	*Cents.*	*Cents.*	*Cents.*	*H. m.*	*H. m.*	
No. 2	25	9	16.13	9 10	55 00	$8.87
No. 3	25	9	14.66	9 40	58 00	8.50
No. 5	22.5	8	14.59	9 40	58 00	8.46
No. 6	35	10	17.46	9 40	58 00	10.13
All establishments	35	8	15.42	9 35	57 30	8.87
1908.						
No. 2	23.5	11	16.36	9 10	55 00	9.00
No. 3	30	12	18.90	7 30	45 00	8.51
No. 5	26.5	12	19.76	9 10	55 00	10.87
No. 6	32	11	19.10	8 37	51 40	9.87
All establishments	32	11	19.17	8 33	51 18	9.83
1910.						
No. 1	22	14	17.63	9 40	58 00	10.23
No. 2	27.5	10	15.04	9 10	55 00	8.27
No. 3	26	11	17.24	9 10	55 00	9.48
No. 5	28	10	17.63	7 30	45 00	7.93
No. 6	35	12	19.97	9 30	57 00	11.38
All establishments	35	10	18.02	9 14	55 24	9.98
1914.						
No. 1	28.5	15	19.88	8 20	50 00	9.94
No. 2	30	12	17.56	8 20	50 00	8.78
No. 3	34	13	20.92	8 20	50 00	10.46
No. 5	18	10	16.00	9 10	55 00	8.80
No. 6	32	10	21.71	9 30	57 00	12.37
All establishments	34	10	20.07	8 45	52 30	10.54

TABLE 36.—NET EARNINGS, LENGTH OF AVERAGE WORKING DAY AND OF FULL-TIME WEEK, AND AVERAGE EARNINGS PER WEEK OF MACHINE HANDS OPERATING LATHE MACHINES IN COTTON-SPINNING MACHINERY PLANTS, 1906, 1908, 1910, AND 1914.

Years and establishments.	Earnings per hour.			Average working hours per day.	Average working hours in full-time week.	Average earnings in full-time week.
	Highest.	Lowest.	Average.			
1906.	*Cents.*	*Cents.*	*Cents.*	*H. m.*	*H. m.*	
No. 3	36.22	8	15.77	9 40	58 00	$9.15
No. 5	22.5	10	15.40	9 40	58 00	8.93
No. 6	23.33	12.5	14.94	9 40	58 00	8.67
All establishments	36.22	8	15.68	9 40	58 00	9.09
1908.						
No. 3	28	9	17.04	7 30	45 00	7.67
No. 5	26.5	17	20.00	9 10	55 00	11.00
No. 6	30	14	18.10	8 37	51 40	9.35
All establishments	30	9	17.28	7 44	46 24	8.02
1910.						
No. 3	28.45	10	17.36	9 10	55 00	9.55
No. 5	30	17	23.75	7 30	45 00	10.69
No. 6	37	9	17.46	9 30	57 00	9.95
All establishments	37	9	17.43	9 13	55 18	9.64
1914.						
No. 3	35	15	20.74	8 20	50 00	10.37
No. 5	30	21	26.33	9 10	55 00	14.48
No. 6	30	15	19.72	9 30	57 00	11.24
All establishments	35	15	20.55	8 42	52 12	10.73

TABLE 37.—NET EARNINGS, LENGTH OF AVERAGE WORKING DAY AND OF FULL-TIME WEEK, AND AVERAGE EARNINGS PER WEEK OF MACHINE HANDS OPERATING PLANING AND MILLING MACHINES IN COTTON-SPINNING MACHINERY PLANTS, 1906, 1908, 1910, AND 1914.

Years and establishments.	Earnings per hour.			Average working hours per day.	Average working hours in full-time week.	Average earnings in full-time week.
	Highest.	Lowest.	Average.			
1906.	*Cents.*	*Cents.*	*Cents.*	*H. m.*	*H. m.*	
No. 2	23	12	14.62	9 10	55 00	$8.04
No. 3	30	7	17.06	9 40	58 00	9.89
No. 5	25	7	15.54	9 40	58 00	9.01
No. 6	27.5	10	16.34	9 40	58 00	9.48
All establishments	30	7	16.51	9 39	57 54	9.56
1908.						
No. 2	35	9	16.83	9 10	55 00	9.26
No. 3	35	15	20.58	7 30	45 00	9.26
No. 5	29	12	18.29	9 10	55 00	10.06
No. 6	30	15	17.87	8 37	51 40	9.23
All establishments	35	9	18.22	8 43	52 18	9.53
1910.						
No. 2	25	10	16.36	9 10	55 00	9.00
No. 3	33	12	19.77	9 10	55 00	10.87
No. 5	29	10	18.04	7 30	45 00	8.12
No. 6	32	14	19.39	9 30	57 00	11.05
All establishments	33	10	18.61	8 56	53 36	9.97
1914.						
No. 2	25	13	17.89	8 20	50 00	8.95
No. 3	38	16	22.08	8 20	50 00	11.04
No. 5	29	14	18.55	9 10	55 00	10.20
No. 6	32	12	20.58	9 30	57 00	11.73
All establishments	38	12	20.11	8 48	52 48	10.62

TABLE 38.—NET EARNINGS, LENGTH OF AVERAGE WORKING DAY AND OF FULL-TIME WEEK, AND AVERAGE EARNINGS PER WEEK OF MACHINE HANDS OPERATING TOP FLAT MACHINES IN COTTON-SPINNING MACHINERY PLANTS, 1906, 1908, 1910, AND 1914.

Years and establishments.	Earnings per hour.			Average working hours per day.	Average working hours in full-time week.	Average earnings in full-time week.
	Highest.	Lowest.	Average.			
1906.	*Cents.*	*Cents.*	*Cents.*	*H. m.*	*H. m.*	
No. 1	25	12	16.75	9 40	58 00	$9.72
No. 5	20	8	13.92	9 40	58 00	8.10
All establishments	25	8	15.08	9 40	58 00	8.75
1908.						
No. 1	30	14	20.56	7 30	45 00	9.25
No. 5	24	16	19.83	9 10	55 00	10.91
All establishments	30	14	20.36	7 57	47 42	9.71
1910.						
No. 1	30	14	19.05	9 40	58 00	11.05
No. 5	24	16	19.83	7 30	45 00	8.92
All establishments	30	14	19.23	9 10	55 00	10.58
1914.						
No. 1	35	16	21.17	8 20	50 00	10.59
No. 5	24	12	18.75	9 10	55 00	10.31
All establishments	35	12	20.20	8 40	52 00	10.50

Table No. 39 shows the per cent of increase or decrease in hours, rates of wages, and weekly earnings. The only decreases in wage rates for 1914 as compared with 1906 are for annealers and helpers and electricians and helpers. There are so few employees in each of these occupations that this decrease might be occasioned by an increase in the proportion of helpers, naturally reducing the average rate. The greatest increase is 84.56 per cent, shown for storekeepers. This occupation shows an increased rate for each period, which is explained by the fact that the manufacturers are becoming from period to period more interested in better storekeeping methods and are employing higher-class men.

The smallest per cent of increase shown, with the exception of the increase for roll coverers and plumbers, occupations employing so few hands that they may be left out of the discussion, was for pattern makers, and amounts to 11.03 per cent, comparing 1914 with 1906. Pattern makers have always received higher wages than most of the other employees. In 1906 at five plants they and their helpers averaged $0.235 per hour, and in 1914 $0.261.

TABLE 39.—PER CENT OF INCREASE OR DECREASE IN FULL-TIME HOURS PER WEEK, RATES OF WAGES PER HOUR, AND FULL-TIME WEEKLY EARNINGS IN THE PRINCIPAL OCCUPATIONS, 1914, COMPARED WITH 1906, 1908, AND 1910.

Occupations.	Full-time hours per week, higher (+) or lower (−) in—			Rate of wages per hour, higher (+) or lower (−) in—			Full-time weekly earnings, higher (+) or lower (−) in—		
	1914 than in 1906.	1914 than in 1908.	1914 than in 1910.	1914 than in 1906.	1914 than in 1908.	1914 than in 1910.	1914 than in 1906.	1914 than in 1908.	1914 than in 1910.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Annealers and helpers	− 9.58	− 9.09	− 7.24	− 1.27	− 8.56	− 1.20	−10.71	−16.86	− 8.38
Bench and machine hands	− 1.72	+10.25	+ 2.52	+38.16	+10.33	+24.50	+35.77	+21.64	+27.63
Blacksmiths and helpers	− 7.59	+ 7.41	− 2.19	+22.52	+ 9.93	+15.09	+13.47	+18.28	+12.81
Brush and comb makers	− 1.72	.....	.00	+36.66	.....	+ 2.59	+34.20	+ 2.54	+ .00
Card clothiers and grinders	− 1.72	+10.25	.00	+31.45	+ 2.39	+13.92	+29.18	+12.83	+13.89
Casting cleaners	− 9.31	+ 8.90	− 5.57	+12.69	+ 6.42	+ 8.29	+ 2.18	+15.91	+ 2.18
Core makers	− 5.17	+ 5.77	− 2.31	+21.80	+ 4.93	+ 9.86	+15.54	+11.02	+ 7.33
Cupola hands	− 2.76	+ 4.44	+ 7.22	+12.02	+13.21	+ 5.42	+ 8.88	+18.26	+12.98
Draftsmen	−10.41	− 3.97	− 3.97	+27.66	+26.84	+34.20	+14.36	+21.80	+28.89
Electricians and helpers	− 6.38	−12.73	− 6.38	−12.69	− 5.56	+ 4.54	−18.27	− 6.77	− 2.15
Erectors and helpers	− 8.65	+ 3.94	− 2.58	+29.79	+11.92	+22.15	+19.46	+16.39	+17.08
Erectors and helpers, outside	− 8.66	+ 2.38	− 2.82	+32.74	+22.91	+20.82	+21.24	+25.81	+17.36
Janitors and watchmen	− 5.17	.00	+22.22	+13.04	+ 3.41	+ 3.54	+ 7.16	+ 3.46	+26.53
Laborers	− 4.01	+ 3.63	+ .11	+19.96	+ 2.96	+ 8.44	+15.11	+ 6.65	+ 8.68
Machine hands	− 6.10	+ 8.67	− 4.77	+27.05	+11.35	+13.39	+19.33	+20.00	+ 7.44
Machine hands, automatic	− 8.70	+ 2.34	− 5.23	+30.16	+ 4.69	+11.38	+18.83	+ 7.22	+ 5.61
Machine hands, lathe	−10.00	+12.50	− 5.61	+31.06	+18.92	+17.90	+18.04	+33.79	+11.31
Machine hands, planing and milling	− 8.81	+ .95	− 1.49	+21.80	+10.37	+ 8.06	+11.09	+11.44	+ 6.52
Machine hands, top flat	−10.34	+ 9.01	− 5.45	+34.22	− .79	+ 5.04	+20.00	+ 8.14	− .66
Machinists and helpers	−10.65	+ 4.44	− 4.78	+17.11	+ 6.08	+10.59	+ 4.63	+10.76	+ 5.32
Masons	−10.86	.....	.....	+28.35	.....	.....	+14.40	.....	.....
Molders and helpers, machine	− 9.66	+ 4.38	− 2.55	+40.94	+21.61	+15.11	+27.41	+26.99	+10.14
Painters	− 8.70	+ 6.09	− 5.06	+21.07	+ 4.10	−12.84	+10.57	+10.32	− 7.04
Pattern makers and helpers	− 4.70	+ 7.25	+ 2.05	+11.03	+ .15	− 4.01	+ 5.79	+ 7.39	− 2.06
Plumbers	− 5.17	.00	+22.22	+ 6.00	.00	.00	+ .55	.00	+22.21
Polishers and grinders	− 6.60	+ 8.03	− 3.93	+17.66	+ 8.43	+ 8.37	+ 9.89	+17.12	+ 4.18
Power-plant employees	−10.80	+ 4.35	− 8.03	+ 9.99	+ 8.29	+ 2.99	− 1.85	+13.01	− 5.27
Roll coverers	− 9.09	− 9.09	.....	+ 1.00	+ 3.73	.....	− 8.09	− 5.68	.....
Storekeepers	− 2.93	+ 2.36	+25.11	+84.56	+77.71	+57.14	+79.31	+81.94	+96.67
Tinsmiths	− 6.60	+ 1.75	− 5.59	+24.21	+12.75	+16.60	+16.02	+14.70	+10.14
Woodworkers and carpenters	− 6.26	+ 6.31	− 2.88	+25.99	+12.23	+ 8.65	+18.10	+19.35	+ 5.50

WELFARE OF EMPLOYEES.

WHITIN MACHINE WORKS, WHITINSVILLE, MASS.

The Whitin Machine Works is one of the early established industries of New England, and has had a steady and consistent growth over a long period of years. In the early part of the nineteenth century small quantities of iron ore found in this vicinity were worked up into agricultural implements by a small blacksmith shop located here. One of the early cotton mills was shortly afterwards founded at Whitinsville, and the call for textile machinery and tools was responsible for the development of the small foundry equipment here into a machine shop. The Whitin Machine Works date from 1833, when this first shop was built.

The village of Whitinsville has about 5,000 people and is part of the town of Northbridge. Its prosperity is dependent entirely upon the success and growth of the Whitin Machine Works, the only other industries there being one small mill and a small shop for the manufacture of spinning rings.

Touching briefly upon the history of the concern, it might be stated that it was started by a member of the Whitin family, and has remained under the control of this family ever since. The owners have always lived in Whitinsville, being part of the community and interested in all its varying developments and activities. To a large extent its freedom from labor troubles and the prosperity and contentment of the people may be attributed to the community interest existing between the owners and the workmen.

The early prosperity of the shop was largely due to the inventive ability of Mr. John C. Whitin, who was one of the first to develop certain machines that enter into the organization of the cotton mill.

The first labor employed was native American, to which, in due course, were added Scotch, English, Irish, and in later years French Canadian, Dutch, and Nova Scotian. Still later some German, Polish, and Scandinavian families were employed, and very recently for some foundry work, Armenians.

Owing to the isolated situation of Whitinsville, which is not near any large city, it has been necessary for the Whitin Machine Works to build, to a large extent, the houses necessary for the employees. From the very beginning there has been a continuous development in this respect, most of the early dwellings having been torn down and replaced by houses of more modern construction. The management has tried to follow the principle of building as comfortable a house as it seemed feasible to rent at a low figure. In other words, it is the aim to make the cost of living in the village as low as possible, encouraging the workmen to settle down there and become useful citizens in the community. A large proportion of the houses are occupied by native Americans, Dutch, English, and Irish.

There are 677 dwelling houses, and in addition, to take care of the single men, there are three boarding houses and one hotel, which furnish accommodations for approximately 300. The rents vary from $4 to $9 per month. The $4 houses have five, six, and seven rooms, while the $9 house is built for two families, has eight rooms, and includes bath, electric lights, furnace, and other modern improve-

ments. Water is supplied without charge, and the town has a sewer system, with which all tenements are connected. It is possible for the tenant of a $4 house to have electric lights installed at an extra charge of 25 or 50 cents a month, according to size of the house. The houses, in general, are heated by hot-air furnaces. A workman can have a well-appointed modern dwelling equipped with electric lights, furnace, and running water and connected with the sewerage for an average of $6.50 per month.

It has been the policy of the corporation to avoid, if possible, entering into the field of private business, but to keep prices down it has been found advisable to furnish coal and wood to the village inhabitants. The Whitin Machine Works sell these supplies at cost plus freight and delivery charges. The electric car line, which is controlled by the corporation, supplies workman's tickets at the rate of 2½ cents a ride.

This welfare work of the corporation extends also in another direction, that is, in the care of the houses. All the streets, being private, are kept up by the Whitin Machine Works, lawns are mowed, shrubbery and trees planted and cared for, and every encouragement is offered to employees to make their homes look attractive.

No part of the village has been set aside for any particular class of people. The houses are assigned, as far as possible, in the order in which the applications are received, also taking into consideration the length of service of the employee. The arrangement of the houses, and their location, bordering on two or three ponds, make the conditions healthy and desirable in every respect. There are excellent schools, many churches, and the town is a self-governing community which is free from strife and racial jealousies, although there are probably 11 nationalities represented.

In busy times as many as 3,300 people are employed. Under fair conditions the average number is approximately 2,500, many of whom come from the neighboring farms and villages. The majority of the people occupying the houses have been in the employ of the corporation from 20 to 25 years.

In the history of the concern there have been no labor troubles involving a strike. There was some trouble in the foundry department several years ago, the Armenian element refusing to work with one or two Turks. This, however, was amicably adjusted after a few days, and with this exception the relations of the employers and employees have been most friendly and pleasant.

The company takes much pride in the town organization. The dwelling-house property does not pay an adequate return on the amount of money employed on an investment basis, but the comfort of the employees with the accompanying good will toward the company, which contributes very materially to its success, more than compensates for any loss on the investment.

SACO-LOWELL SHOPS, NEWTON UPPER FALLS, MASS.

This establishment has recently made a good beginning in welfare work and elaborate plans have been made for its extension as soon as there is a revival in the industry. About a year ago a large hotel building of concrete was constructed, with all modern conveniences.

It has accommodation for about 75 lodgers, and the dining room can accommodate about 150 persons. The rooms are nearly all designed for occupancy by one person each, although the corner rooms are larger and have accommodations for two persons. Throughout the hotel, in the kitchen, dining room, bedrooms, and in the lavatories, the latest sanitary appliances have been installed. The interior walls are painted and there are no surfaces anywhere in any of the rooms of the hotel where dust and dirt can accumulate. Everything was found to be immaculately clean.

The hotel is used exclusively by male employees of this and other establishments in the town. The prices for room and board are $5.50 per week for the single rooms, and $5 each per week for persons occupying double rooms. Persons not in the employ of the Saco-Lowell shops must pay $1 more.

Attached to the hotel is a large modern steam laundry with all the latest appliances. This laundry is used not only to accommodate persons in the employ of the company, but it also does a general laundry business for other people in the town at the regular rates.

Another building connected with this establishment contains a club room, dance hall, bowling alley, pool rooms, and boathouses. When visited, one of the rooms was used as a schoolroom. The boathouse contains a large number of canoes and rowboats owned by the company, which are rented at reasonable rates to employees and others in the town. It is also used as a storage place for privately owned boats. These conveniences are for general use of the people in the town, but the employees pay 20 per cent less for the privileges.

The company also owns about 40 dwelling houses which it rents to its employees at a rate of about $2 per month per room; that is, rents vary from $8 per month for a four-room house to about $12 per month for one of six or seven rooms. Nearly all of the houses are detached modern one-family frame dwellings, a few being semi-detached. Those within the city proper have water and sewer connection and other city conveniences, the toilets in all cases being within the dwellings. Those outside the town limits, which do not have these conveniences, are occupied by foreigners and the rents are cheaper.

The company recently employed a landscape gardener and architect who devised a very elaborate town plan for a new section which is now vacant land owned by the company. This plan provides for extensive parking, tree planting, water and sewer connections, a large playground and athletic field, and as soon as the industry revives it is the intention of the company to carry out the design.

The company derives a net income of from 1 to 2 per cent on the housing investment. The indirect benefits derived from providing these housing and other accommodations more than compensate, however, for any direct financial loss, and it will be the policy to extend this welfare work to other plants as soon as practicable.

CHAPTER VIII.

FOREIGN AND DOMESTIC TEXTILE MACHINERY.

IMPORTS.

The tariff act at present in force shows the following classification of textile machinery with the import duty thereon:

	Per cent.
Textile machinery:	
Embroidering and lace-making machines, including machines for making lace curtains, nets, or nettings	25
Jute manufacturing machinery	20
All other	20
Card clothing, not actually and permanently fitted to and attached to carding machines, or parts of, manufactured with—	
Round iron or untempered round steel wire	10
Tempered round steel wire	35
Plated wire, or other than round iron or steel wire, or with felt-face, wool-face, or rubber-face cloth containing wool	35

The cotton textile machines from the bale opener to the spinning frame, such as would enter into competition with the machines made in the establishments covered by this investigation, are included among others in the class designated above as "All other."

Since it is impossible, therefore, to obtain from the published statistics of imports any figures which would be of interest in this connection, the special agents engaged upon this investigation compiled from the original invoices on file in the United States appraisers' offices in Boston, New York, and Philadelphia data showing the imports of each kind of machine from January 1, 1909, to May 22, 1915. Over 99 per cent of the cotton textile machinery imported came through the port of Boston. These figures are shown in Table 40, which follows:

TABLE 40.—IMPORTATIONS OF ENGLISH COTTON TEXTILE MACHINERY, FROM BALE OPENER TO SPINNING FRAME AND INCLUDING ALSO LOOMS, SHOWN BY INVOICES IN THE UNITED STATES APPRAISERS' OFFICES IN BOSTON, NEW YORK, AND PHILADELPHIA, JANUARY 1, 1909, TO MAY 22, 1915.

Machines.	Jan. to Dec., 1909.	Jan. to Dec., 1910.	Jan. to Dec., 1911.	Jan. to Dec., 1912.	Jan. to June, 1913.	July 1, 1913, to June 30, 1914.	July 1, 1914, to May 22, 1915.	Total.
Openers	28	64	34	31	16	42	63	278
Breaker machine	.....	3	.....	2	.....	12	28	45
Finisher machine	.....	3	.....	2	.....	12	28	45
Revolving flat cards	301	279	105	49	13	12	27	786
Combing machines	[a] 365	[b] 364	245	[c] 189	4	121	52	1,340
Ribbon lap machines	35	26	33	37	.....	18	7	156
Sliver lap machines	54	55	36	28	.....	17	5	195
Drawing frames, heads [d]	14	36	22	2	10	4	10	98
Drawing frames, deliveries [d]	72	211	123	8	15	16	40	485
Slubbers	13	32	9	16	.....	1	1	72
Intermediates	20	50	39	42	3	1	0	155
Roving	113	311	44	113	9	19	2	611
Mules	117	128	*95	53	4	0	4	401
Ring spinning frames	0	8	0	75	0	0	0	83
Looms	0	0	10	26	0	0	0	36

[a] Includes 6 French combs.
[b] Includes 19 French combs.
[c] Includes 2 French combs.
[d] The number of heads and deliveries was reported instead of the number of drawing frames.

As American manufacturers, with one exception, do not make fine-yarn machines, the 401 mule spinning machines, 36 looms, 1,340 combers, with 156 ribbon lap and 195 sliver lap machines, a total of 2,128 machines, can not be said to be as competitive as the other machinery recorded in this table of imports. From 1906 to 1914, however, 3,300 American-made combers, 482 ribbon lap, and 582 sliver lap machines have been sold in the United States.

Of the 583 imported machines other than drawing frames, 15 per cent were imported in 1909; 42 per cent in 1910; 25 per cent in 1911; 2 per cent in 1912; 4 per cent in the six months, January to June, 1913; 3 per cent in the year ending June 30, 1914; and 9 per cent in about 11 months from July, 1914, to May, 1915. A similar falling off is shown in the number of drawing-frame heads and deliveries.

This indicates that the sale of English cotton textile machinery in the United States has been steadily decreasing, and that the reduction of the tariff duties in October, 1913, from 45 per cent to 20 per cent ad valorem has not given any apparent impetus to the sale of English machines.

There are six English manufacturers of cotton textile machinery who export to the United States and who are represented by their own agencies in Boston or by importing houses.

As an interesting contrast to the quantity of spinning machinery imported by American cotton mills, the following table, although not strictly within the scope of this report, is reproduced from the Tariff Board report on wool and manufactures of wool (p. 1042). It will be noted that while less than 9 per cent of the spinning machinery used in cotton mills in America is imported, the contrary is the case in the woolen industry, which imports 78 per cent of its spinning machinery. The table shows the number of foreign and domestic machines in the wool manufacturing establishments investigated at that time. Of the 22 per cent of yarn-producing machinery which is domestic, cards, for both wool and worsted, and mules for carded wool form the larger part. Of looms the woolen mills import only 23 per cent.

TABLE 41.—NUMBER AND PER CENT OF THE PRINCIPAL WOOLEN AND WORSTED MILL MACHINES OF NATIVE AND FOREIGN MANUFACTURE USED IN CERTAIN ESTABLISHMENTS IN THE UNITED STATES.

Machines.	Total.	Manufactured in United States.		Manufactured in foreign countries.	
		Number.	Per cent.	Number.	Per cent.
Scouring machines	67	37	55.2	30	44.8
Carding machines, woolen	433	399	92.2	34	7.8
Carding machines, worsted	658	331	50.3	327	49.7
Gill boxes, English Bradford combing	[a] 757	37	5.0	702	95.0
Gill boxes, French combing	125	.....	.....	125	100.0
Noble combs	380	57	15.0	323	85.0
French combs	277	.....	.....	277	100.0
English (Bradford) drawing frames	[b] 2,500	273	10.9	2,227	89.1
French drawing frames	489	.....	.....	489	100.0
Spinning frames	1,346	113	8.4	1,233	91.6
Mules, carded wool	588	504	85.7	84	14.3
Mules, worsted	370	.....	.....	370	100.0
Total	7,990	1,751	22.0	6,221	78.0
Weaving looms	12,337	9,517	77.1	2,820	22.9

[a] Including 18 gill boxes, place of manufacture not reported.
[b] Including 80 drawing frames, place of manufacture not reported.

EXPORTS.

The classification of exports from the United States as published in the official reports shows all textile machinery under the one head—textile machinery. It is therefore impossible to ascertain how much of each of the several lines has been exported. It was found, however, from the books of the manufacturers, that the whole amount of cotton-spinning machinery exported was so small as to be practically negligible. Most of the textile machines exported are automatic looms, knitting machines, and other patented and highly specialized machinery developed in this country.

The capacity of the cotton-spinning machinery plants is greater than the domestic demand except during the years when the demand is at the very highest point. This is one of the reasons why plants at different periods are forced to run at reduced time. As demonstrated in all manufacturing lines, economy and efficiency are greatly increased when plants are running at or near capacity. Unit overhead charges are materially reduced by spreading the overhead over a greater volume of sales. It is then possible to keep intact the most efficient forms of organization as well as to purchase supplies advantageously for future needs. With the present production capacity of the domestic plants, if they are to be run at maximum efficiency, it is absolutely necessary either that the domestic demand increase or that foreign trade be obtained in order to find a market for the surplus product.

If this is accomplished, American machinery will be produced much cheaper, and the result should be to help the American manufacturer to compete with similar products in foreign markets.

For the fiscal years ended June 30, the value of all textile machinery exported from the United States was $1,968,383 during 1913 and $1,611,279 during 1914.

Table 42, which follows, shows the countries to which such machinery was exported, with the values, and Table 43 shows the values by customs districts. It must be remembered, however, that this report deals with cotton-spinning machinery only, and cotton-spinning machinery is not exported to any appreciable extent; therefore these tables relate mostly to other classes of textile machines.

TABLE 42.—EXPORTS OF DOMESTIC TEXTILE MACHINERY,[a] YEARS ENDING JUNE 30, 1913 AND 1914, BY COUNTRIES TO WHICH EXPORTED.

Exported to—	1913	1914	Exported to—	1913	1914
Europe:			South America:		
United Kingdom	$540,171	$465,511	Argentina	$23,633	$9,876
Germany	118,350	128,060	Brazil	26,849	8,547
Austria-Hungary	61,474	132,937	Colombia	92,922	1,078
France	67,198	49,405	Other South American countries	5,540	2,863
Belgium	8,344	12,559			
Italy	6,931	11,734	Total	148,944	22,364
Netherlands	12,340	7,019			
Spain	10,774	10,069	Asia:		
Other European countries	16,599	23,814	Japan	39,346	10,608
			Hongkong	16,441	48,329
Total	842,181	841,108	Other Asiatic countries	4,754	3,894
			Total	60,541	62,831
North America:					
Canada	858,568	670,799	Oceania	17,467	1,609
Mexico	37,155	9,197	Africa: British South Africa	300	448
Other North American countries	3,227	2,923	Total exports	1,968,383	1,611,279
Total	898,950	682,919			

[a] Included in "All other machinery" prior to 1913.

TABLE 43.—EXPORTS OF TEXTILE MACHINERY FROM THE UNITED STATES, YEARS ENDING JUNE 30, 1913 AND 1914, BY CUSTOMS DISTRICTS.

Districts.	1913	Districts.	1914
Bangor, Me	$67,542	Maine and New Hampshire	$19,270
Boston	218,101	Massachusetts	285,277
New York	849,855	New York	621,245
Passamaquoddy, Me	3,521	Philadelphia	36,693
Philadelphia	38,395	San Francisco	6,001
San Francisco	9,943	Buffalo	115,763
Buffalo Creek, N. Y	56,191	Duluth and Superior	89,885
Cape Vincent, N. Y	318	Eastern Vermont	257,578
Champlain, N. Y	23,769	St. Lawrence	110,363
Memphremagog	531,950	Western Vermont	69,204
Minnesota	4,849		
Niagara Falls, N. Y	135,672		
Vermont, Vt	28,277		
Total	1,968,383	Total	1,611,279

FOREIGN AND DOMESTIC MACHINES IN AMERICAN COTTON MILLS.

In order to ascertain the number of foreign and domestic machines which are at present installed in the cotton mills of the United States blank schedules were sent to every mill in the country. These schedules requested information to show the kind of machine, the name of the builder, when built, and when installed in the mill. Complete returns were received from mills representing approximately 21,000,000 spindles.

Table 44 shows for five-year periods the number of foreign and domestic machines of each kind installed in the American cotton mills reported upon.

TABLE 44.—NUMBER OF DOMESTIC AND FOREIGN MACHINES INSTALLED IN AMERICAN COTTON MILLS, BY FIVE-YEAR PERIODS.

Machines.	1910–1914	1905–1909	1900–1904	1895–1899	1890–1894	1885–1889	1880–1884	1875–1879	1870–1874	Before 1870	Date not given.	Total.
Openers, pickers, and lappers:												
Domestic	1,650	1,955	2,348	1,245	1,128	243	72	46	14	13	873	9,587
Foreign	94	49	292	51	61	8	14	.....	.....	2	34	605
Cards:												
Domestic	10,162	10,698	11,810	5,572	2,493	971	511	598	166	474	5,017	48,472
Foreign	476	674	1,023	530	1,847	1,199	87	.....	.....	.....	959	6,795
Combing machines (heads):[a]												
Domestic	5,843	4,312	2,474	22	457	1	.....	.....	.....	.....	1,292	14,401
Foreign	3,167	2,736	2,877	3,440	2,156	1,014	1,520	222	64	.....	951	18,147
Combing preparation:												
Domestic	503	712	150	5	20	.....	.....	.....	.....	.....	54	1,444
Foreign	219	404	611	139	186	40	24	9	.....	.....	103	1,735
Drawing (heads):[a]												
Domestic	16,414	15,145	16,777	7,882	3,071	1,110	469	77	100	39	6,850	67,934
Foreign	1,029	762	1,994	1,113	2,192	1,527	443	.....	.....	.....	1,097	10,157
Railway heads:[a]												
Domestic	621	375	153	125	63	101	38	24	12	32	112	1,656
Foreign	.....	4	10	.....	.....	.....	.....	.....	.....	.....	.....	14
Slubbers (spindles):[a]												
Domestic	62,229	69,715	76,481	34,408	19,663	10,501	7,123	2,904	2,085	2,041	33,436	320,586
Foreign	3,197	3,195	10,773	3,634	5,685	4,676	2,498	160	.....	.....	5,404	39,222
Roving, etc. (spindles):[a]												
Domestic	792,812	699,990	721,545	366,183	249,572	129,948	62,825	19,214	24,401	9,246	453,425	3,529,161
Foreign	75,952	69,411	172,927	116,304	112,719	48,388	46,355	3,262	.....	.....	40,273	685,591
Ring spinning (spindles):[a]												
Domestic	4,168,453	3,532,881	4,125,557	2,023,975	1,372,698	584,699	510,235	85,263	58,283	38,447	2,075,098	18,575,589
Foreign	6,940	8,280	46,476	.....	.....	.....	1,764	.....	.....	.....	.....	63,460
Mule spinning (spindles):[a]												
Domestic	53,435	89,627	76,706	70,613	77,622	21,779	29,422	6,936	43,080	50,564	147,089	666,873
Foreign	177,592	256,408	327,255	158,685	359,450	80,583	46,462	4,080	73,368	12,240	137,780	1,624,903
Twisters (spindles):[a]												
Domestic	348,994	401,674	276,119	130,754	116,277	69,477	195,338	730	1,162	8,596	171,182	1,720,303
Foreign	1,140	1,580	4,235	975	.....	320	.....	.....	2,400	.....	.....	10,650
Spoolers (spindles):[a]												
Domestic	180,070	164,997	200,061	85,329	58,012	29,346	28,988	2,834	6,763	3,756	125,522	885,678
Foreign	2,630	3,499	3,256	200	1,600	66	.....	60	12	.....	1,300	12,623
Warpers:												
Domestic	1,422	1,115	1,437	726	554	287	187	33	35	17	796	6,609
Foreign	1	2	2	.....	6	.....	.....	.....	.....	.....	13	24
Slashers:												
Domestic	363	355	604	250	140	60	53	33	11	7	182	2,058
Foreign	12	16	21	14	9	8	2	5	3	.....	38	128

[a] The number of heads and spindles was reported instead of the number of drawing, spinning, and other frames.

TABLE 44.—NUMBER OF DOMESTIC AND FOREIGN MACHINES INSTALLED IN AMERICAN COTTON MILLS, BY FIVE-YEAR PERIODS—Continued.

Machines.	1910–1914	1905–1909	1900–1904	1895–1899	1890–1894	1885–1889	1880–1884	1875–1879	1870–1874	Before 1870	Date not given.	Total.
Looms:												
Domestic	110,301	81,763	99,673	45,451	32,139	15,736	14,963	3,358	8,588	1,292	49,089	462,353
Foreign	189	163	71	6	71	69	90	.....	21	.....	516	1,196
Cloth finishers:												
Domestic	430	399	517	194	174	45	60	10	7	.....	304	2,140
Finishers	38	13	.....	53	.....	.....	.....	.....	.....	.....	50	154
Sundry:												
Domestic	15,965	2,422	1,365	2,804	82	41	110	.....	8	.....	1,992	24,789
Foreign	16	3	11	9	.....	.....	.....	.....	.....	.....	16	55

Table 45 shows the total number of foreign and domestic machines installed in the establishments reported upon and the percentage of each.

TABLE 45.—NUMBER AND PER CENT OF DOMESTIC AND FOREIGN MACHINES INSTALLED IN AMERICAN COTTON MILLS.

Machines.	Number.			Per cent.	
	Domestic.	Foreign.	Total.	Domestic.	Foreign.
Openers, pickers, and lappers	9,587	605	10,192	94.06	5.94
Cards	48,472	6,795	55,267	87.70	12.30
Combing machines (spindles)[a]	14,401	18,147	32,548	44.25	55.75
Combing preparation	1,444	1,735	3,179	45.42	54.58
Drawing (heads)[a]	67,934	10,157	78,091	86.99	13.01
Railway (heads)[a]	1,656	14	1,670	99.16	.84
Slubbers (spindles)[a]	320,586	39,222	359,808	89.10	10.90
Roving, etc. (spindles)[a]	3,529,161	685,591	4,214,752	83.73	16.27
Ring spinning (spindles)[a]	18,575,589	63,460	18,639,049	99.66	.34
Mule spinning (spindles)[a]	666,873	1,624,903	2,291,776	29.10	70.90
Twisters (spindles)[a]	1,720,303	10,650	1,730,953	99.38	.62
Spoolers (spindles)[a]	885,678	12,623	898,301	98.59	1.41
Warpers	6,609	24	6,633	99.80	.20
Slashers	2,058	128	2,186	94.17	5.83
Looms	462,353	1,196	463,549	99.74	.26
Cloth finishers	2,140	154	2,294	93.29	6.71
Sundry	24,789	55	24,844	99.78	.22

[a] The number of spindles and heads was reported instead of the number of drawing, spinning, and other frames.

This table shows that in only three cases was there a preponderance of foreign machines, namely, combing machines, 55.75 per cent; combing preparation, 54.58 per cent; and mule spinning, 70.90 per cent. These are fine-yarn machines, and for many years were not made in this country. Since 1900, however, more domestic than foreign combing and combing preparation machinery has been installed. In six cases the foreign machines installed constituted less than 1 per cent, namely, railway heads, ring spinning, twisters, warpers, looms, and sundries.

In Tables 46 and 47 the number of foreign and domestic machines installed in American cotton mills is shown by States.

TABLE 46.—NUMBER OF DOMESTIC MACHINES INSTALLED IN AMERICAN COTTON MILLS, BY STATES.

States.	Openers, etc.	Cards.	Combing machines (heads).	Combing preparation.	Drawing (heads).	Railway heads.
Alabama	409	1,981	.....	.....	3,166	2
Arkansas	8	33	.....	.....	56	.....
California	10	120	.....	.....	100	.....
Connecticut	337	2,071	1,055	46	2,245	94
Delaware	21	.....	.....	.....	32	.....
Georgia	1,208	5,645	.....	360	8,589	140
Illinois	40	267	54	14	396	51
Indiana	47	194	.....	.....	316	2
Kansas	11	48	.....	80	.....	.....
Kentucky	44	197	.....	4	278	.....
Louisiana	32	157	.....	.....	346	.....
Maine	420	1,538	192	10	2,750	246
Maryland	56	305	.....	.....	500	.....
Massachusetts	2,097	10,755	7,079	504	12,983	192
Mississippi	57	261	.....	.....	432	.....
Missouri	33	130	.....	.....	195	10
New Hampshire	285	1,262	40	4	1,216	177
New Jersey	62	366	.....	.....	371	4
New York	370	2,129	909	80	2,730	189
North Carolina	1,422	7,802	1,650	78	12,255	211
Oklahoma	5	39	.....	.....	28	.....
Pennsylvania	106	319	1,700	10	741	34
Rhode Island	212	2,087	1,093	159	1,814	81
South Carolina	1,885	8,496	626	94	13,232	207
Wisconsin	6	45	.....	.....	3	5
Virginia	166	983	.....	.....	1,206	.....
Tennessee	165	876	.....	.....	1,308	11
Texas	71	366	2	1	646	.....
Vermont	2	.....	.....	.....	.....	.....
Total	9,587	48,472	14,401	1,444	67,934	1,656
Groups of States:						
Southern	5,582	27,271	2,278	537	42,269	581
New England	3,353	17,713	9,460	723	21,008	790
All other	652	3,488	2,663	184	4,657	285

States.	Slubbers (spindles).	Roving, etc. (spindles).	Ring spinning (spindles).	Mule spinning (spindles).	Twisters (spindles).	Spoolers (spindles).
Alabama	15,242	103,848	652,748	3,000	57,122	29,596
Arkansas	908	912	6,806	.....	204	400
California	.....	1,236	24,608	.....	3,050	1,236
Connecticut	8,718	209,914	645,770	226,360	114,564	37,987
Delaware	136	1,400	14,720	.....	.....	.....
Georgia	41,761	275,614	1,579,876	29,014	154,646	95,952
Illinois	1,584	28,562	25,958	.....	4,012	4,160
Indiana	1,248	8,736	74,976	.....	1,560	2,620
Kansas	384	1,408	10,608	.....	.....	520
Kentucky	1,618	7,504	55,364	.....	2,934	2,420
Louisiana	1,016	5,432	31,344	.....	1,392	1,260
Maine	16,396	140,158	696,048	43,584	20,646	30,774
Maryland	2,102	5,855	47,176	.....	19,158	4,674
Massachusetts	53,277	919,993	5,458,378	155,980	540,917	235,404
Mississippi	2,068	15,844	95,930	.....	5,574	3,446
Missouri	3,604	4,422	31,900	265	2,118	1,976
New Hampshire	5,512	61,510	364,034	11,520	8,618	20,836
New Jersey	1,482	21,204	172,103	.....	213,083	14,567
New York	11,562	156,066	568,428	22,960	35,842	18,814
North Carolina	56,212	450,729	2,504,893	62,124	284,574	128,522
Ohio	.....	.....	.....	.....	280	584
Oklahoma	208	960	5,712	.....	1,892	400
Pennsylvania	2,648	22,346	144,956	8,370	37,186	17,801
Rhode Island	7,948	173,005	763,126	55,376	73,004	40,510
South Carolina	69,237	763,878	3,852,966	48,320	105,543	160,317
Wisconsin	140	480	2,112	.....	640	1,450
Virginia	7,131	69,966	370,989	.....	8,010	13,458
Tennessee	6,212	56,420	281,708	.....	20,340	10,722
Texas	2,232	18,423	84,160	.....	3,364	4,872
Vermont	.....	3,336	8,192	.....	.....	400
Total	320,586	3,529,161	18,575,589	666,873	1,720,303	885,678
Groups of States:						
Southern	209,687	1,781,207	9,616,292	142,723	666,871	458,015
New England	91,851	1,507,916	7,935,548	492,820	757,779	365,911
All other	19,048	240,038	1,023,749	31,330	295,653	61,752

TABLE 46.—NUMBER OF DOMESTIC MACHINES INSTALLED IN AMERICAN COTTON MILLS, BY STATES—Continued.

States.	Warpers.	Slashers.	Looms.	Cloth finishers.	Sundry.
Alabama	206	60	13,321	27	1,747
Arkansas	3	1	160	1	.....
California	2	2	180	4	.....
Connecticut	332	41	21,296	81	346
Delaware	586	2	248	.....	.....
Georgia	.....	173	35,408	206	207
Illinois	16	3	634	2	65
Indiana	26	7	1,842	2	.....
Kansas	5	2	236	2	.....
Kentucky	37	12	2,506	.....	.....
Louisiana	.....	.....	.....	6	21
Maine	179	70	19,153	65	26
Maryland	26	250	245	2	3
Massachusetts	2,071	637	136,948	584	12,072
Mississippi	38	11	2,531	13	6
Missouri	12	4	730	.....	.....
New Hampshire	110	33	6,986	141	15
New Jersey	62	7	6,272	8	836
New York	119	34	11,361	6	7,568
North Carolina	816	220	49,436	257	1,328
Ohio	13	.....	57	.....	1
Oklahoma	.....	.....	.....	.....	3
Pennsylvania	161	14	12,753	114	231
Rhode Island	426	94	26,718	60	122
South Carolina	1,130	312	94,084	423	111
Wisconsin	3	.....	70	.....	3
Virginia	102	31	10,714	85	67
Tennessee	74	18	5,611	29	4
Texas	49	19	2,452	22	1
Vermont	5	1	401	.....	.....
Total	6,609	2,058	462,353	2,140	24,789
Groups of States:					
Southern	3,079	1,113	217,446	1,071	3,501
New England	3,123	876	211,502	931	12,581
All other	407	69	33,405	138	8,707

TABLE 47.—NUMBER OF FOREIGN MACHINES INSTALLED IN AMERICAN COTTON MILLS, BY STATES.

States.	Openers, etc.	Cards.	Combing machines (heads).	Combing preparation.	Drawing (heads).	Railway heads.
Alabama	13	159	35	10	330	.....
Connecticut	8	476	1,948	435	403	.....
Georgia	5	184	98	10	289	.....
Illinois	9	61	.....	.....	.....	.....
Kentucky	10	34	.....	.....	.....	.....
Maine	3	564	16	1	186	.....
Massachusetts	214	3,890	11,476	749	6,948	11
Mississippi	.....	19	.....	.....	24	.....
New Hampshire	17	161	220	10	32	.....
New Jersey	38	503	2,398	112	981	.....
New York	10	71	142	18	113	.....
North Carolina	29	124	176	18	167	.....
Pennsylvania	15	241	44	11	278	.....
Rhode Island	228	44	1,092	120	181	.....
South Carolina	.....	190	438	233	193	.....
Tennessee	6	26	.....	.....	26	.....
Texas	.....	25	.....	.....	.....	.....
Vermont	.....	20	56	4	.....	.....
Virginia	.....	.....	8	4	.....	.....
Total	605	6,795	18,147	1,735	10,157	14
Groups of States:						
Southern	63	761	755	275	1,029	.....
New England	470	5,158	14,808	1,319	7,753	14
All other	72	876	2,584	141	1,375	.....

TABLE 47.—NUMBER OF FOREIGN MACHINES INSTALLED IN AMERICAN COTTON MILLS, BY STATES—Continued.

States.	Slubbers (spindles).	Roving, etc. (spindles).	Ring spinning (spindles).	Mule spinning (spindles).	Twisters (spindles).	Spoolers (spindles).
Alabama	760	7,428	18,720	.....	1,640	.....
California	.....	.....	.....	.....	1,950	.....
Connecticut	1,140	30,666	.....	210,616	2,400	2,800
Georgia	1,694	6,200	.....	12,480	.....	.....
Illinois	180	1,720	.....	16,000	.....	.....
Kentucky	228	.....	.....	12,690	.....	.....
Maine	.....	4,000	.....	39,600	.....	.....
Massachusetts	22,186	464,535	5,472	1,034,393	3,520	5,447
Mississippi	.....	120	1,764	.....	.....	.....
New Hampshire	64	3,040	.....	.....	.....	.....
New Jersey	3,328	72,012	6,788	.....	120	.....
New York	1,156	14,800	.....	95,546	520	1,668
North Carolina	3,660	26,282	18,288	.....	.....	160
Pennsylvania	1,316	15,836	2,680	58,466	.....	1,020
Rhode Island	888	23,448	6,748	134,912	500	1,528
South Carolina	1,800	12,556	.....	.....	.....	.....
Tennessee	102	1,796	3,000	.....	.....	.....
Texas	720	1,152	.....	.....	.....	.....
Vermont	.....	.....	.....	10,200	.....	.....
Total	39,222	685,591	63,460	1,624,903	10,650	12,623
Groups of States:						
Southern	8,964	55,534	41,772	25,170	1,640	160
New England	24,278	525,689	12,220	1,429,721	6,420	9,775
All other	5,980	104,368	9,468	170,012	2,590	2,688

States.	Warpers.	Slashers.	Looms.	Cloth finishers.	Sundry.
Alabama	.....	2	.....	12	.....
California	2	.....	420	.....	.....
Connecticut	.....	8	68	.....	.....
Georgia	.....	6	.....	.....	18
Illinois	.....	.....	.....	.....	.....
Kentucky	.....	.....	.....	.....	.....
Maine	.....	2	.....	.....	1
Massachusetts	.....	83	90	26	23
Mississippi	.....	.....	.....	.....	.....
New Hampshire	2	.....	62	116	.....
New Jersey	.....	2	8	.....	6
New York	1	.....	39	.....	.....
North Carolina	.....	.....	.....	.....	1
Pennsylvania	.....	.....	243	.....	6
Rhode Island	7	14	264	.....	.....
South Carolina	12	10	2	.....	.....
Tennessee	.....	.....	.....	.....	.....
Texas	.....	1	.....	.....	.....
Vermont	.....	.....	.....	.....	.....
Virginia	.....	.....	.....	.....	.....
Total	24	128	1,196	154	55
Groups of States:					
Southern	12	19	2	12	19
New England	9	107	484	142	24
All other	3	2	710	.....	12

RELATIVE MERITS OF FOREIGN AND DOMESTIC MACHINERY.

Some of the cotton textile machines of a generation ago were crude and imperfect imitations of English machines. American machine manufacturers have not hesitated in the early copying of English inventions, but they have not stopped with that—they have brought them up to the highest standard. A New Bedford cotton mill manufacturer of years of experience in the use of English and American machines stated to the agent of the Bureau that he "would obtain equally good results in production and quality from a mill equipped

with all-American machinery and from one equipped with all-English machinery." Preferences were expressed at the different mills at which inquiries were made as to the merits of American and English machines. An overseer of a carding room, who was a graduate of the Lowell Textile School, preferred an English card of a certain make, stating that it was more durable on account of its heavier construction, and, though running for a great many years, was without vibration or shaking of parts. A Fall River superintendent said that a certain make of English cards was heavier, had less vibration, and that the cylinders ran truer than other English or American makes. They were also more durable, had heavier castings, stronger bearings, better finishing, were of more accurate gauge, and truer. The disadvantages were in waiting for supplies and parts. The English threads in nuts and bolts differed in standard and style, making it difficult to fit them when repairs were necessary.

There was little difference, however, in the quality of stock turned out by native or foreign machines, and excepting for the one make of cards, these manufacturers would not go to England for their machines, nor for card clothing at the present time.

Another superintendent of a large cotton mill in Lowell using both foreign and domestic machines said that in the opening room American bale breakers proved to be fully equal to the best English make. The Creighton openers connected with the bale breakers are all of English make, while all of the finisher breaker pickers were of American make and preferred. In the card room he had two makes of English cards and four of American manufacture. He preferred three of the American makes to the English cards. In drawing frames he had three American and two English makes, and thought there was little or no difference between them. The slubbers, intermediates, and fine frames were both of English and American make. He expressed a decided preference for the American machines. There were two makes of English combers in use, one of which was a more modern machine than the other and gave greater production. Two makes of English mules were in operation, one of which is a newer and stronger machine and gives better results than the other. All of the ring spinning frames were made by three American manufacturers and all gave equally good results. The American makes of flyers in use compare favorably with the English flyers. The spoolers, warpers, slashers, winders, reelers, twisters, and looms were all of American make and efficient. He expressed a decided preference for American card clothing. He also stated that "the handicap in using English machinery is that the parts for replacement were not so readily at hand," and that it is too long to wait for English parts.

Many American mills can and do send to American builders for parts in the rough and do their own finishing at the mill, and can also use such parts for patterns, obtaining gear cutters from the American builders.

One of the American manufacturers explained conditions in the following interesting statement:

> It has been of much advantage to the mills to use machinery built in the United States, as it has enabled them to secure readily and quickly repair parts and supplies, which form a large item of their regular running expenses. It has also been of advantage to the cotton-mill industry as a whole in that the machine shops have quite consistently, where required, granted long lines of credit, covering periods of years, and have invariably shown extreme leniency in enforcing payment of over-due accounts.

This has resulted in many mills, which have later become successful, being started and operated on partial credit. This particular condition is very generally true in connection with the development of the cotton-mill industry in the Southern States.

Also, in lieu of credit, the machine shops have been quite large subscribers to stock in cotton-mill enterprises, the stock subscriptions being taken up as payment for machinery. Of course this stock has invariably been disposed of later, as it has been necessary for the shop to turn it into money, but the purpose has been accomplished of enabling the mill to get started.

During this extended period of progression in their respective lines, the mills have also been greatly dependent on the shops for assistance along experimental lines. Where market conditions have demanded machinery capable of greater production, or machinery capable of producing work of special quality—in the line of fancy yarns or difficult and complicated weaves in fabrics—the problems have invariably been worked out in the experimental departments of the shops, to the mutual benefit of both shop and mill.

Such factors in the intimacy between the shops and the mills as above mentioned have brought about a close association, much more so, unquestionably, than would have been the case had the mills been dependent on foreign countries for the sources of their machinery supplies, and undoubtedly this close relationship, and the sympathetic ties between various groups of mills and the different shops, have materially assisted the splendid development of textile manufacturing, both in the Northern and Southern States, and have also firmly established its position. * * *

The list of the various machines manufactured by the United States' shops includes everything required for the equipment and operation of cotton mills for the regular work of manufacturing yarn and cloth. The only machines which are alone built by foreign shops, not included in the domestic list, are for special operations, and generally along lines in connection with cotton manufacturing which have not been sufficiently developed by the mills here to warrant the machine shops taking them up.

Another large American concern has furnished the following statement:

From the early days, 1824 to 1831, the business has grown steadily along with the development of the cotton-manufacturing industry of the country, and the machine shops have been of inestimable value to the growth of the mills.

Between the years 1872 and 1890 a large amount of English machinery was imported in this country, and our machine shops found it necessary, in order to meet this competition, to revise some of their patterns of carding machinery, and accordingly began building revolving flat carding machines after the English pattern, which machines have been generally adopted in the United States, and the American-built card now has the preference. In return the English adopted the American pattern of ring spinning frame, which has largely taken the place of mules for certain kinds of yarns all over the world. The Draper loom is another American machine which is being universally used.

All the textile mills of the world require an immense amount of repairs and renewals at all times, and if our American shops should be put out of business and unable to furnish these, the American mills would be at a hopeless disadvantage in world competition.

CHAPTER IX.

CARDS AND CARD CLOTHING.

While the construction of a standard 40-inch revolving flat card weighing more than 6,000 pounds is a work of a great deal of labor and expense, it is useless for the purpose intended until its cylinder and doffer and its 110 top flats are covered with card clothing. This clothing consists of a foundation cloth set with teeth made of round, bright, hardened and tempered steel wire. It is not the machine that does the actual carding, but the teeth of the card clothing, which open the cotton, straighten the fibers, and make them parallel with one another.

The foundation cloth consists usually of a woven fabric, weighing 22 ounces per square yard, made of linen warp and woolen filling, which is cemented between two layers of cotton cloth, the latter woven from No. 28 warp yarn, 68 threads to the square inch, and from No. 16 filling yarn, 64 threads to the square inch.

Two other kinds of foundations also are used, namely, cotton-cotton-woolen-cotton, and the 4-ply natural india-rubber face cloth.

The cotton-cotton-woolen-cotton foundation is made by cementing one ply of cotton cloth on the linen and woolen fabric with oil cement and two plies of cotton cloth on the other side with rubber cement. This foundation costs 6 cents per square foot more than the cotton-woolen-cotton foundation and is used extensively for making cylinders and doffers.

The four-ply natural india-rubber face foundation is made with three plies of cotton cloth and one ply of fine linen cloth (linen warp, cotton filling), all cemented together with rubber cement and with a natural india-rubber face on the cloth. This foundation costs 0.1095 cent per square foot more than the cotton-woolen-cotton foundation and is used extensively for cylinders and special clothing.

An automatic machine, into which is fed the straight steel wire, forms the wire into staples and sets them into the foundation cloth, 34,560 to 93,312 points per square foot. The staples or teeth are then ground to smooth and even points.

To make a complete set of card clothing for a standard 40-inch revolving flat card requires $131\frac{1}{4}$ square feet of card-cloth foundation and 110 pounds of wire. This produces $95\frac{1}{24}$ square feet of wire surface, which is used on the different parts of the card as follows: Card cylinder, $44\frac{1}{6}$ square feet; doffer, 24 square feet; and tops or flats, $26\frac{7}{8}$ square feet.

For the cylinder the clothing is made into strips, or fillets, 2 inches wide, and for the doffer into fillets $1\frac{1}{2}$ inches wide. For the flats, which are strips of cast iron about 42 inches long by $1\frac{1}{4}$ inches wide, 110 in number on each American card, it is made into narrow sheets called tops. The number of teeth varies according to the purpose of the piece of clothing, the doffer and the flats having usually the same number of points, the cylinder slightly less.

The strips are wound spirally upon the cylinder and the doffer, by machinery, and fastened by tacks driven into hardwood plugs which have been inserted in the metal in parallel rows. The method of applying the clothing to the flats has changed greatly in the past 20 years. In one establishment these changes have been as follows:

Originally a long series of small holes were drilled the entire length of each side of the casting. Corresponding holes were punched by hand through the clothing, which was then fastened to the flat casting by means of lead rivets, which were put into the holes by hand and headed over, or riveted by hand. In this manner a man could finish about 25 flats per day. This method, however, while it held the clothing securely, had a tendency to weaken the flats and cause them to deflect. Now no holes are drilled in the flat. Special machinery is used to make special steel clips, which have small teeth cut in them by means of which to attach them to the clothing. The clip is then made to fasten the clothing securely to the flat by means of machines specially designed by this company. After the clips and end plates have been attached to the clothing and the tops cut to width and finished, a man can attach the clothing to 275 flats per day. It takes three men for the entire process on that number of flats per day.

It is of interest to note that of the two largest American manufacturers of cotton cards one buys American card clothing almost exclusively, while the other in the past has given preference to the English product. Neither American nor English manufacturers of cards make card clothing. This is made in independent establishments.

There are seven English manufacturers of card clothing who are also exporters to the United States. American cotton card clothing is produced mainly by five concerns. All of these make clothing for wool and worsted cards as well as cotton. Cotton card clothing differs materially both in foundation fabric and teeth from that used for carding wool. There is but one concern in the United States that manufactures cotton card clothing principally.

Up to a recent period all of the raw materials—the cloth foundation and the steel wire—were imported from England. In 1912 about 50 per cent of American-made steel wire was used, while by 1915 less than 10 per cent of the steel wire used in cotton card clothing was imported.

COST OF PRODUCTION OF CARD CLOTHING.

As only one American establishment gives its whole attention to the manufacture of cotton card clothing, complete information concerning the cost of production can not be published without disclosing the operations of that establishment, and had to be omitted therefore from this report.

MATERIALS.

The clothing required for a standard 40-inch revolving flat card is the basis in the following statement. Imported cloth foundation only is considered, but the cost of both foreign and domestic wire is given. The cloth is of two grades, and the years represented are 1913 and 1914, under the old and new tariffs.

TABLE 48.—COSTS PER LINEAR YARD OF IMPORTED CLOTH FOUNDATION FOR CARD CLOTHING, 22 OUNCES WEIGHT PER SQUARE YARD, COMPOSED OF LINEN WARP AND WOOLEN FILLING.

Items.	Old tariff, May, 1913.	New tariff, May, 1914.
Cost f. o. b. factory England	$0.8100	[a] $0.8460
Import duties (50 per cent in 1913, 35 per cent in 1914)	.4050	.2961
Freight transportation and other charges (6 per cent in 1913, 8 per cent in 1914)	.0486	.0676
Buying commission, etc	.0405	.0424
Total cost per yard delivered in United States	1.3041	1.2521

[a] This cost was for an order placed Dec. 20, 1913. The price has been advancing since that date on account of abnormal conditions in England.

On April 22, 1915, an order for 20 pieces of this foundation was placed in England at the following price per linear yard:

Net cost f. o. b. factory England	$1.074
Duty (35 per cent)	.374
Charges (8 per cent)	.085
Buying commission, etc. (5 per cent)	.053
Total per linear yard delivered in the United States	1.586

TABLE 49.—COSTS PER LINEAR YARD OF IMPORTED COTTON CLOTH FOUNDATION MATERIAL, 130 YARDS IN LENGTH BY 54 INCHES IN WIDTH, COMPOSED OF NO. 28 TWO-PLY WARP YARN, 68 THREADS TO THE SQUARE INCH, AND OF NO. 16 ONE-PLY FILLING YARN, 64 THREADS TO THE SQUARE INCH.

Items.	May, 1913.	May, 1914.
Cost f. o. b. factory England	$0.1732	$0.1682
Import duties (30 per cent in 1913, 12½ per cent in 1914)	.0519	.0210
Freight transportation and other charges (6 per cent in 1913, 8 per cent in 1914)	.0103	.0134
Buying commissions, etc	.0076	.0083
Total cost per yard delivered in the United States	.2430	.2109

The clothing for a 40-inch revolving flat card requires 110 pounds of round, bright, hardened and tempered steel wire. The imported wire is No. 32 and the domestic wire of the same kind and grade is No. 33.

TABLE 50.—COST PER POUND OF IMPORTED NO. 32 STEEL WIRE, ROUND, BRIGHT, HARDENED, AND TEMPERED.

Items.	Old tariff, 1912.	New tariff, 1914.
Cost f. o. b. factory, England	$0.1133	$0.1133
Import duty (35 per cent in 1912, 15 per cent in 1914)	.0396	.0170
Freight transportation, etc. (6 per cent in 1912, 8 per cent in 1914)	.0067	.0091
Buying commissions, etc	.0056	.0056
Total cost per pound delivered in the United States	.1652	.1450

The cost of imported wire to the American manufacturer was reduced 2 cents per pound by the reduction in tariff, bringing it down to 14.5 cents per pound. The cost of No. 33 wire, manufactured in the United States and delivered at the factory, in 1915 was 18 cents

per pound. Thus the cost of making card clothing in this country is materially increased when American wire is used.

American card-clothing manufacturers state, however, that there are advantages in using American wire which offset the difference in costs. The imported wire is not as uniform in temper as the American wire, it is asserted, some of it is rusty, and imperfect wire can not be returned. If imperfect wire is received from the American manufacturer, however, it is returned and replaced. The American wire is also said to be more uniform in temper, consequently does not cause much trouble on the machines and makes more perfect clothing, thus bringing the cost of finishing, etc., actually lower than if imported wire were used.

LABOR.

The following table shows the machine labor cost of card clothing per square foot in the several departments of the factory, namely, machine room, grinding room, and finishing room, from 1906 to 1914.

TABLE 51.—MACHINE LABOR COST PER SQUARE FOOT OF WIRE SURFACE OF MAKING COTTON CARD CLOTHING AT AN AMERICAN ESTABLISHMENT, 1906 TO 1914.

Years.	Machine room.	Grinding room.	Finishing room.	Total.
1906	$0.066	$0.029	$0.038	$0.133
1907	.062	.028	.035	.125
1908	.064	.034	.031	.129
1909	.062	.030	.029	.121
1910	.060	.027	.030	.117
1911	.061	.027	.031	.119
1912	.060	.025	.030	.115
1913	.063	.025	.033	.121
1914	.061	.026	.033	.120

Machine-room labor included the operators of machines, their helpers, foreman, and one odd laborer. Grinding-room labor included operators of grinding machines, one laborer, and one foreman, also one man who is the inspector of work of the grinding room and one man repairing emery wheels. Finishing-room labor included an inspector, trimmers, packers, and a foreman.

OCCUPATIONS AND WAGES.

The table following shows the occupations in a card-clothing manufactory, with the rate of wages per hour and the hours and earnings of each operative in a full-time week.

The employees are all males excepting "wire inserters and inspectors," who are females and work but 54 hours in a full-time week.

Wire-machine tenders operate machines which automatically insert the wire into the foundation cloth in staple form, thus making the wire cloth.

Twenty fillet machines are attended by one machine operator and 14 endless sheet machines by one operator.

Grinding-machine tenders grind sides and surface of wire to make the point desired.

The emery-wheel repairer repairs the emery wheels used by grinders.

Flat clothiers attach card clothing to iron flats.

The flat stripper removes old clothing from top flats.

The flat-top puncher punches teeth in clamp for attaching to top flat.

Card clothiers attach clothing to cards.

Trimming-machine tenders trim edges of fillet and top card clothing.

As stated, 20 automatic wire machines are operated by one man. Each machine is fed with straight wire and it sets 300 wire card teeth per minute, which is 18,000 per hour and 1,044,000 teeth per full week of 58 hours per machine. In a specific grade of cloth there are 36,000 teeth per square foot.

Theoretically 20 machines should produce 582 square feet. A record of a man who ran 20 machines, 10 of them setting at the rate of 375 teeth per minute and 10 at the rate of 300 per minute, shows that he actually set 574 square feet, losing 78 square feet, or about 12 per cent, per week.

TABLE 52.—OCCUPATIONS AND RATE OF EARNINGS PER HOUR AND FOR A FULL TIME WEEK OF EMPLOYEES IN AN AMERICAN FACTORY MAKING CARD CLOTHING.

Occupations.	Rate of earnings per hour.	Hours worked per full-time week.	Earnings per full-time week.
Wire-machine tenders	$0.40	58	$23.20
Do	.34	58	19.72
Do	.30	58	17.40
Do	.25	58	14.50
Apprentices	.15	58	8.70
Do	.10	58	5.80
Do	.08	58	4.64
Grinding-machine tenders	.20	58	11.60
Do	.17½	58	10.15
Grinding-machine helper	.15	58	8.70
Emery-wheel repairer	.20	58	11.60
Grinding-room clothing inspector	.20	58	11.60
Machinists	.31	58	17.98
Do	.30	58	17.40
Do	.27½	58	15.95½
Do	.25	58	14.50
Do	.22½	58	13.05
Do	.21	58	12.18
Do	.20	58	11.60
Do	.17½	58	10.15
Do	.17	58	9.86
Flat clothier	.17	58	9.86
Flat grinder	.17	58	9.86
Flat stripper	.15	58	8.70
Flat-clip puncher	.17	58	9.86
Card clothiers	.36	58	20.88
Cloth-foundation cutter	.17	58	9.86
Card-cloth cementers	.15	58	8.70
Do	.14	58	8.12
Wire inserters and inspectors	.15	54	8.10
Trimming-machine tenders	.22	58	12.76
Do	.17½	58	10.15
Do	.17	58	9.86
Do	.15	58	8.70
General helper	.15	58	8.70
Carpenter	.25	58	14.50
Case maker	.17	58	9.86
Sweeper	.15	58	8.70
Foreman	.51⅔	58	30.00
Do	.32½	58	18.85
Do	.....	58	24.00
Engineer and fireman	.....	58	13.50
Night watchman	.....	58	10.50

COST OF IMPORTED CARDS.

The selling price of imported cards in the United States in 1910 and 1914 was $695 and $690, respectively. The items of cost, from the factory in England to the place of delivery in Boston, are shown in the following table:

TABLE 53.—PRICE AT FACTORY, DELIVERY COSTS TO BOSTON, AND SELLING PRICE OF HIGHEST GRADE ENGLISH CLOTHED 40-INCH REVOLVING FLAT CARD, 106 FLATS, 27-INCH DOFFER, 12-INCH COILER, FLAT STRIPPING COMB, FLAT GRINDING APPARATUS.

Items.	November, 1910.	December, 1914.	Items.	November, 1910.	December, 1914.
Card, list price at factory, England:			Freight factory to Liverpool	$0.29	$0.53
Revolving flat card [a]	$358.78	$405.29	Total	2.34	2.29
Less discounts	69.98	96.85	Clothing cost, delivered, Liverpool	89.87	87.92
Net	288.80	308.44	Cost at Liverpool, card and clothing	414.55	433.09
Cost of packing cases	21.17	20.43	Ocean transportation, Liverpool to Boston	9.99	34.86
Cost of packing	6.10	7.56	Insurance	1.16	1.22
Freight, factory to Liverpool	8.61	8.74	Consul fees and other charges	2.06	2.56
Total	35.88	36.73	Wharfage	1.49	1.53
Card cost, delivered, Liverpool	324.68	345.17	Import duties	189.11	94.40
Card clothing, list price, factory	124.80	122.38	Total cost, delivered in Boston	618.36	567.66
Less discounts	37.27	36.75	Importers' selling price in United States	695.00	690.00
Net	87.53	85.63	Margin of difference, including cartage, fitting, office and general expenses, and profit	76.64	122.34
Cost of packing cases	1.56	1.51			
Cost of packing	.49	.25			

[a] The list price of the flat grinding apparatus in 1910 was $12.16 and $15.32 in 1914.

NOTE.—The 1914 card has improvements over the 1910 and a higher list price.
In 1910 the import duty on machinery was 45 per cent ad valorem; on card clothing, 45 cents per square foot. In 1914 the import duty on machinery was 20 per cent ad valorem; on card clothing, 35 per cent ad valorem.

The additional costs of the English cards added to the factory costs, under the Payne-Aldrich and under the Underwood-Simmons tariff laws, and the percentage the added costs are of the factory costs are shown in the following table:

TABLE 54.—NET COST AT FACTORY AND ADDED EXPENSES OF DELIVERING ENGLISH CARDS INTO THE UNITED STATES IN 1910 AND IN 1914, WITH PERCENTILE RELATION OF EXPENSE OF DELIVERY, INCLUDING IMPORT DUTIES TO FACTORY COSTS.

Items.	1910		1914	
	Amount.	Per cent of factory cost.	Amount.	Per cent of factory cost.
Net cost at factory	$405.65	.....	$423.82	.....
Freight from factory to Liverpool	8.90	2.19	9.27	2.19
Ocean transportation to Boston	9.99	2.46	34.86	8.23
Insurance	1.16	.29	1.22	.29
Consul fees and other charges	2.06	.51	2.56	.60
Wharfage	1.49	.37	1.53	.36
Total, other than import duties	23.60	5.82	49.44	11.67
Import duties	189.11	46.62	94.40	22.27
Total	212.71	52.44	143.84	33.94
Total, delivered at Boston	618.36	.....	567.66	.....

APPENDIX A.

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APPENDIX B.

MAKERS OF COTTON TEXTILE MACHINERY.

Commencing their operations during the second quarter of the last century, the cotton textile machine manufacturers of New England have grown and developed with the corresponding expansion of the cotton-mill industry.

The following is a list of the existing cotton textile machinery manufacturers which furnish the cotton mills of the United States with 87 per cent of their carding machinery, 92 per cent of their spinning machinery, and practically all of their looms:

The Whitin Machine Works, shops at Whitinsville, Mass.—Revolving-top flat cards, drawing frames, railway heads, sliver lap machines, ribbon lap machines, combing machines, slubbing frames, intermediate frames, roving frames, jack frames, ring spinning frames, twister frames, spoolers, reels and quillers, looms, and waste machinery.

Saco-Lowell shops (4 shops): Lowell shop, at Lowell, Mass.—Ring spinning frames, slasher machines, and looms.

Kitson shop, at Lowell, Mass.—Picker machines.

Newton shop, at Newton Upper Falls, Mass.—Revolving-top flat cards, drawing frames and evener drawing.

Biddeford shop, at Biddeford, Me.—Ring spinning frames, slubbing frames, intermediate frames, roving frames, jack frames, twisters, spoolers, and warpers.

Howard & Bullough American Machine Co., shops at Pawtucket, R. I.—Picker machines, revolving-top flat cards, drawing frames, roving machinery, and ring spinning frames.

Fales & Jenks Machine Co., Pawtucket, R. I.—Ring spinning frames and twisting rames.

Potter & Johnson Machine Co., Pawtucket, R. I.—Picker machines and revolving-top flat cards.

Woonsocket Machine & Press Co., Woonsocket, R. I.—Drawing frames and roving rames.

Mason Machine Works, Taunton, Mass.—Revolving-top flat cards, drawing frames, spinning frames, and looms.

Easton & Burham Machine Co., Pawtucket, R. I.—Spooling and winding and machinery and reels.

T. C. Entwistle Co., Lowell, Mass.—Warping and beaming and machinery.

Draper Co., Hopedale, Mass.—Northrop automatic looms

Crompton Knowles Co., Worcester, Mass.—Looms.

Kilburn Machine Co., Fall River, Mass.—Looms

Stafford Loom Co., Readville, Mass.—Looms.

It will be noted that in the above list of American manufacturers there are but five concerns building revolving-top flat cards, five building drawing frames, four building roving frames, five building ring spinning frames, one building combing machine, and seven building looms.

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